THE IRON AGE

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Iron and Steel of Ancient Origin

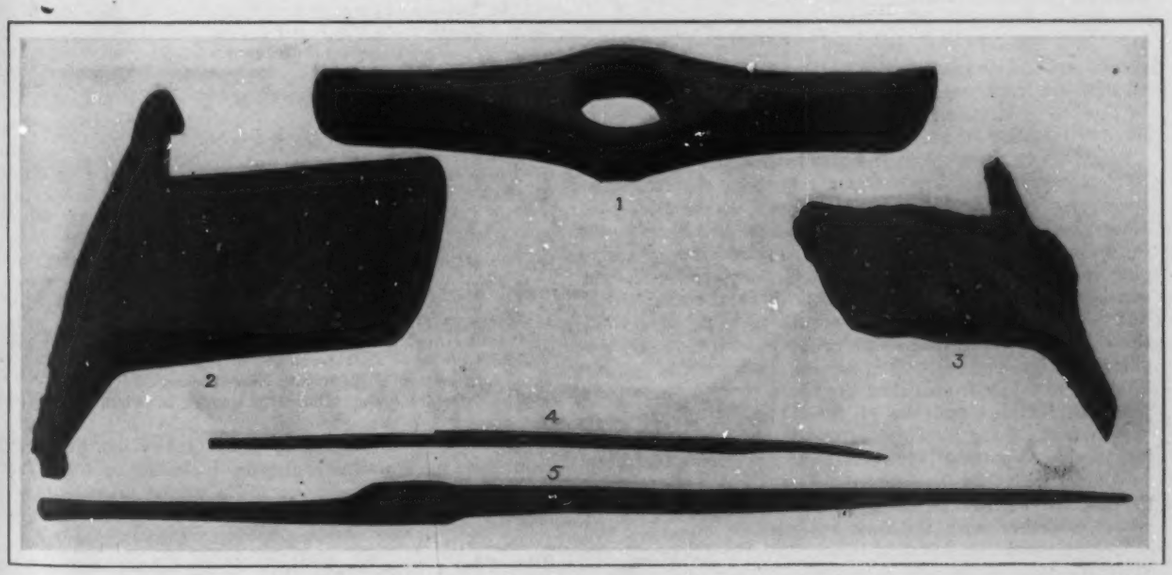
The Oldest Specimens of Iron and Steel in Existence Found in India and Egypt

A paper of absorbing interest was presented at the Iron and Steel Institute meeting of May 9, in London, England, by Sir Robert A. Hadfield, entitled "Sinhalese Iron and Steel of Ancient Origin." This paper, however, was of far wider scope than indicated in the title, as it embodied much information obtained by the author in researches in other portions of India and in Egypt as well as a great deal of matter secured from the writings of others who had preceded him in investigations of this fascinating subject. Sir Robert showed at the meeting specimens of iron and steel from some of the buried cities of Ceylon which he obtained from the Colombo Museum through the kindness of the Governor-General of Ceylon, Sir Henry McCallum. Analyses and other metallurgical information regarding these specimens are given in the paper. In *The Iron Age* of January 4, 1912, an article specially contributed for that issue by Sir Robert was published which treated to some extent of ancient Sinhalese iron and steel and reproduced photographs of some of the specimens referred to. A reprint of the paper read at the Iron and Steel Institute meeting gives a considerable number of plates showing the specimens of iron now in the Colombo Museum which were taken from the following buried cities of Ceylon: Anuradhapura, 437 B.C. to 769 A.D.; Polonnaruwa, 769 A.D. to 1319 A.D.; Sigiriya, 479 A.D. The articles thus shown comprise parts for agricultural implements, cutting instruments, tools for building and other trades, spear heads, etc. The specimens number several hundred, are unquestionably 1200 to 1800 years old and are in a remarkably good state of preservation.

Crucible Steel Made in India Long Before England Made It

Among other authorities quoted, Sir Robert refers to a report by the Director of the Colombo Museum, Dr. Arthur Willey, in which the statement is made that the ancient Indian method of making steel in clay crucibles seems to be identical with the method thought to have been invented in England in the middle of the eighteenth century, referring, of course, to the crucible process credited to Benjamin Huntsman. Papers contributed to the Royal Asiatic Society in 1837 and 1839 by J. M. Heath appear to establish the fact that processes of making iron and steel have been used in India for many thousands of years and that it may be taken as established that the crucible process has been used in Ceylon for a long period of time. Heath not only claims that the Hindoos had been familiar with the manufacture of steel from time immemorial, but holds the opinion that the great stone works of Egypt could only have been carried out by tools of iron, probably of cemented or hardened steel, an opinion in which Sir Robert coincides.

Dr. Coomaraswamy, who was until a few years ago the principal mineral surveyor in Ceylon, is cited in supplying evidence that the ancient Hindoos were not only skilled in manufacturing steel and iron but in working these products and in tempering steel. It is claimed, indeed, that Damascus blades were fashioned from Indian iron. The ondanique or Indian steel of Kirman, which Marco Polo mentions, was so called from its comparative excellence, and the swords of Kirman were eagerly sought after in the fifteenth and sixteenth centuries by the Turks, who



Remarkable Specimens of Ancient Egyptian Iron: No. 1, Double Axe, 400 B. C. Nos. 2 and 3, Hatchets, 700 B. C. No. 4, Knife, 700 B. C. No. 5, Knife with a Cast Bronze Handle, 800 B. C.

gave great prices for them. Arrian mentions steel as imported into the Abyssinian ports, and Salmasius mentions that among surviving Greek treatises was one "On the Tempering of Indian Steel"

The manufacture of crucible cast steel by the Sinhalese is now almost an extinct industry, as steel can be imported from Europe more cheaply than it can be manufactured locally.

The Delhi and Dhar Pillars

Another section of the paper treats of the great iron Delhi and Dhar pillars in India. The pillar of Delhi is a solid shaft of wrought iron and has a total length of 23 ft. 8 in., of which 22 ft. is above and 20 in. below ground; the upper diameter is 12½ in. and the lower diameter 16½ in.; the total weight is about 6 tons. It ends in a bulb like an onion, held in place by eight short thick rods of iron on which it rests and which at their lower extremity are let into blocks of stone in which they are secured by lead. The iron of which the pillar is made seems to have been originally in blooms of about 80 lb. weight each. In a communication to *The Iron Age*, dated August 21, Sir Robert states that he had been able to obtain specimens from the pillar, from which on analysis the following results were obtained, being probably the first time that a complete analysis has been given of the material of which it is composed:

	Per cent.
Carbon	0.080
Silicon	0.046
Sulphur	0.006
Phosphorus	0.114
Manganese	nil
Total of elements other than iron	0.246
Iron	99.720
Total	99.966

Specific gravity, 7.81 per cent. Ball hardness, No. 186.

"It will be noticed," says Sir Robert, "that the material is an excellent type of wrought iron, the sulphur being particularly low, indicating that the fuel used in its manufacture and treatment must have been very pure (probably charcoal). There is no manganese present—a somewhat special point, as wrought iron usually contains manganese. The iron was ascertained by actual analysis and not by 'difference.'"

For the specimens from the pillar which were thus analyzed Sir Robert is indebted to J. H. Marshall, Director-General of Archeology in India. On this subject the following excerpt is taken from a report of the executive engineer of the Delhi Provincial Division to the Director-General of Archeology: "Mr. Marshall said that, in handing over to Sir Robert A. Hadfield the two kinds of chippings taken from the iron pillar at Qutab near Delhi, one consisted of rust scales taken off with the help of chisel and hammer strokes from an area of 14 in. by 5 in., and the other kind consisted of chippings chiseled out of the pillar itself, weighing a little over two ounces. Both kinds were taken from below the surface of the limestone platform built around the pillar. The iron pillar above the surface of the platform is absolutely free from rust, but the lower portion below the platform, which had been in contact with lime, had rusted. The circular platform at the bottom of the pillar had to be partially removed, which, together with the time occupied in obtaining the chippings, took about two hours. The portion of the platform removed is now being rebuilt."

The iron pillar at Dhar, which is 33 miles west of Indor, and was described by Vincent A. Smith, of the Indian Civil Service, in a paper to the Royal Asiatic Society in 1898, had a total length of no less than 42 ft. The three existing pieces measure 24 ft., 12 ft. and 6 ft. in length, while a fragment is missing The column, therefore, was approximately double the hight of the Delhi pillar. Mr. Smith says: "While we marvel at the skill shown by the ancient artificers in forging the great mass of the Delhi pillar, we must give a still greater measure of admiration to the forgotten craftsmen who dealt so successfully in producing the still more ponderous iron mass of the Dhar pillar monument with its total length of 42 ft., which, like the pillar at Delhi, is of the Gupta period, or about the year 321 of our Christian era."

On July 17, at the 250th anniversary conversazione of the Royal Society, held in Burlington House, Sir Robert showed the chippings from the Delhi pillar and also exhibited, in addition to his own Indian and Ceylon collection, five remarkable specimens of Egyptian iron which he was enabled to present through the courtesy of Dr. Flinders Petrie, one of the most eminent English Egyptologists. A reproduction of a photograph of these Egyptian specimens, furnished by Sir Robert to *The Iron Age*, is given herewith. These specimens, although 23 to 27 centuries old, show no oxidation and look as if they had just come from the forge. The double axe, No. 1, at the top of the engraving, dates about 400 B.C.; the two hatchets, Nos. 2 and 3, about 700 B.C.; the small knife, No. 4, about 700 B.C., and the large knife at the bottom, No. 5, which is provided with a cast bronze handle, about 800 B.C. The double axe is 10½ in. long, and has a hole 1⅜ in. in diameter; the larger hatchet is 4 in. wide at the cutting edge, the blade is ½ in. thick at about 1 in. from the cutting edge, and ⅞ in. thick under the handles; the corresponding dimensions of the smaller hatchet are 3 in., ⅜ in. and ½ in.; the smaller knife is 9½ in. long, the handle is ⅛ in. wide, the blade ½ in. wide, tapering down at the end to ⅛ in.; the larger knife is 14½ in. long, the handle ¼ in. wide, with a thicker portion ⅞ in. wide, the blade being ⅝ in. in width, tapering down to ¼ in. at the tip.

Iron and Steel Institute Fall Meeting

The autumn meeting of the Iron and Steel Institute will be held at Leeds, England, September 30 and October 1 to 4. The list of papers announced is as follows:

Nitrogen and Iron. By J. H. Andrew.

The Solubility of Cementite in Hardenite. By Dr. J. O. Arnold and L. Aitchison.

The Solubility or Diffusion of Hardenite in Ferrite. By Dr. J. O. Arnold and C. Chappell.

The Gases Evolved on Heating Steel to Its Melting Point in a Vacuum. By G. Wesley Austin.

Allotropy in General and that of Iron in Particular. By Dr. C. Benedicks.

A New Type and Method of Construction of Large Gas Engines. By A. E. L. Chorlton.

The Thermal-Magnetic Transformations of 25 Per Cent. Nickel Steel. By Dr. E. Colver-Glauert and Dr. S. Hilpert.

A New Method for the Improvement of the Soundness of Steel Ingots by the Aid of Thermit. By Dr. Hans Goldschmidt.

A Method of Producing Sound Ingots. By Sir Robert A. Hadfield.

A New Method of Revealing Segregation in Steel Ingots. By Sir Robert A. Hadfield.

The Magnetic Properties of Manganese and Nickel Steels. By Dr. S. Hilpert and Dr. W. Mathesius, Worcester, Mass.

The Question of the Existence of Commercial Hyper-Eutetic White Iron Free from Manganese. By Dr. H. M. Howe.

Steel Works Yields. By P. Longmuir and W. H. Robinson.

Some Aspects of Wire Drawing. By P. Longmuir.

The Manufacture of Open-hearth Steel, with Reference to Improvement in Yield. By F. W. Paul.

Rolling-Mill Practice in the United States. By J. Puppe, Breslau.

The Growth of Cast Irons After Repeated Heatings, Parts V and VI. By Prof. H. F. Rugan, New Orleans.

The Iron Ores and Mineral Resources of Chili. By Charles Vattier.

Arrangements have been made for visits to various iron and steel plants in Leeds, including a number of large foundries, a coal mine and a coking plant.

The Gary Screw & Bolt Company's Catalogue

The Gary Screw & Bolt Company, Gary, Ind., is sending out its catalogue No. 1 and official price list, 5½ × 7¾ in. This catalogue has a complete marginal index and is tastefully published. It is bound in a stiff paper cover. The full line of products manufactured by this company includes machine bolts, carriage bolts, coach and lag screws, blank bolts and bolt ends, stud bolts, turned and finished bolts, foundation bolts, stay bolts, truss and bridge rods, patch bolts, hot and cold pressed nuts in all finishes, and a complete line of set and cap screws. An elaborate illustration of each of these products is made possible through the use of highly finished paper. The tables of sizes and list prices are presented with respect to subdivisions, arrangement and clearness of type in a manner to promote easy reference. Tables of weights and areas of bar stock are incorporated. Supplements to this catalogue are to be issued from time to time as occasion may require.

Malleable Casting Practice*

A Discussion of Commercial Tendencies

BY DR. RICHARD MOLDENKE, WATCHUNG, N. J.

As is well known, the production of malleable castings is carried out in America almost entirely with a view of obtaining the "black heart" variety, while in Europe the white steely fracture is the rule. The latter material may be readily machined and finished up with little loss of strength, while the "black heart" suffers seriously if the skin of the casting is removed. The differences lie primarily in the heat treatment given the two varieties of malleable castings in the percentages of phosphorus and sulphur used, and finally in the uses they are put to.

Tendency Toward Making the Least Weight Do the Work

The question of strength is not always a serious one in malleable castings work, so long as a casting is intended to be finished up as part of a machine tool, or where the labor thus expended forms the principal item. Something a little better than cast iron is wanted, and the malleable casting machines up easier than the steel one. Where, however, no labor whatever is intended to be expended upon the malleable casting, as is practically always the case with the "black heart" American variety, there is the somewhat natural tendency toward making the least weight do the work.

Were this commercial consideration always accompanied with the proper understanding of the characteristics of the material involved, there would be no harm done. But where the consumer forces the manufacturer to take chances his better judgment would not sanction, then it becomes a serious matter. In the first place, this continual demand for a better grade of material is a good thing for the development of an industry, since stricter specifications are made and methods of production are improved; in short, a pound of iron is made to go further in the service of man than it could before. On the other side the following may be said: That in the entire range of the casting industry there is a present tendency toward running up the more striking characteristics of a material to a point of excellence at the expense of other but none the less valuable ones. For instance, instead of making use of the ordinary malleable casting, as readily made from good irons under standard conditions, a grade of cast iron made with the plentiful addition of steel to the mixture, and advertised as "semi-steel," is substituted on account of its lower cost. Again, instead of using the steel casting direct, where a high tensile strength is desired, a very-low-total-carbon malleable casting is made to do because it is cheaper.

The result of this short-sighted policy is the production of a series of supposedly high-grade materials which in reality are very unreliable. The principal sufferer is the consumer who does not make any specifications, but gets the bulk of the metal that has to be made to satisfy the one who does. The latter, who may need only a limited quantity, asks for the almost impossible, and the product is probably entirely unsuited for general work.

Attention is directed to the above tendency in America at this time, because the export of "black heart" malleable castings is beginning to be a factor in international trade. With a present American production of some 800,000 tons of these castings, and a capacity of over 1,000,000 tons annually, there is bound to be some investigation on the part of consumers in other countries relative to the merits of the material in question. This in turn compels the producers of those countries to take notice and will naturally affect their practice.

The Use of Steel Scrap

So that the matter may be better understood, a few necessary details of production are given: In regular malleable melting practice, both in Europe and America, a limited amount of steel scrap is added to improve the material. This effects an initial reduction in the total carbon with a consequent increase in the tensile strength of the finished castings. With the very best of irons, short heats, first-class annealing conditions, and in fact the carrying out of the processes which are calculated to give the best results, it is not possible to get a very high tensile strength without sacrificing some of the shock-resisting properties for which the malleable casting is justly famous.

Thus, the ordinary "black heart" product, as tested transversely by means of the 1 in. square test bar placed on supports 12 in. apart, should stand a load of 3000 lb. applied at the center, and give a deflection of at least ½ in., and in exceptionally good material the deflection may run even beyond 2½ in. The tensile strength of such test bars will not run much over 42,000 lb. per sq. in. It is quite possible, by a heavy initial reduction in the total carbon through steel scrap additions, to obtain tensile strengths of above 58,000 lb. per sq. in., and when extreme care has been exercised in the melting and annealing processes to keep oxidation of the metal down to a minimum the deflection will still be good. The chances are, however, so very much against this, even in the highest type establishments, that whoever insists upon this high-grade material and bases the calculation of his structures involving risk of life upon them makes a serious mistake. He had much better specify the steel casting in the first place.

As a mere item to show the delicacy of the manufacturing process there may be mentioned the fact, well known to the producer but perhaps not at all to the consumer, that with composition and manufacturing processes identical up to this point, castings taken from saggers dumped on Monday morning—the one day when the annealing ovens are discharged cold—are much softer, bend and twist better, and are in every way more desirable as malleable castings, than those obtained the other days of the week. Yet the tensile strength of such castings is considerably below those dumped out hot.

Oxidation Not Cheaply Corrected

The malleable casting differs from all others in that any attempt to correct the oxidation of the metal in a heat before pouring so increases the expense that it cannot compete with cast steel. With the addition of much scrap steel to a charge, with the personal equation of the probable low type of melter, and with the probable variations in the annealing temperatures, an attempt to work for very high tensile strengths is not followed by reliable results. The chance of oxidizing the iron in addition to the silicon and manganese is such that a more or less open crystalline structure results, with consequent penetration of further oxygen during the annealing process, weakening the casting. This may be readily seen from the effect of changing to coke irons from the charcoal varieties. Charcoal irons, with their high total carbon and comparative freedom from oxidation as blown in the furnace, when compared with the coke irons, gave the foundryman a chance to obtain good castings in spite of slight unavoidable variations in his practice. In American practice, at least, the change to coke irons has compelled the raising of the silicon specified in pig irons, in order to avoid this chance of initial oxidation as much as possible.

Until we have better melting methods (possibly when the electric furnace has been sufficiently developed along lines of economical production), and until we can obviate or cheaply correct any undue oxidation of the molten metal before it is cast, it would be wise to lay more particular stress upon the development of the malleable casting commercially along lines of greater softness rather than high strength. Where the latter is essential the steel casting is certain to replace it sooner or later. On the other hand, with the specifications so shaped that the resilience of the material is made prominent for ultimate development, the excellences of this peculiar product of the casting industry will be brought out and the material kept in its proper sphere of usefulness.

*Presented to the International Association for Testing Materials, Sixth Congress, New York, September, 1912.

Activity at Shipyards.—Commissioner of Navigation Chamberlain has issued this statement: "The shipyards of the United States during the current fiscal year will be more busily employed than in a decade, according to returns filed with the Bureau of Navigation. On July 1, 1912, the shipyards reported that 120 steel vessels, aggregating 254,000 gross tons, were under construction or under contract to be built, against barely 100,000 tons at the same time a year ago. The influence of the coming opening of the Panama Canal is manifest, as upward of 80,000 tons is building for use through the canal."

Making Copper-Clad Steel Products

Interesting Details of the Process Employed by the Duplex Metals Company—The Plant a Good Example of Steel Frame Factory Construction

Efforts by a number of producers of copper-coated steel products to manufacture such material with a sufficiently heavy and uniform coating of copper satisfactory for commercial products have established the fact that the weakest spot in the product was at the point of the contact between the two metals. With the necessity of overcoming this weakness as an objective point, the Duplex Metals Company, Chester, Pa., has developed a process by which it is able to obtain a product in which the association or welding of the copper and steel has been perfected. After extensive experiments, by which some mechanical means was sought to get the copper to hold to the steel, that of welding the two metals through the medium of a copper-iron alloy was developed.

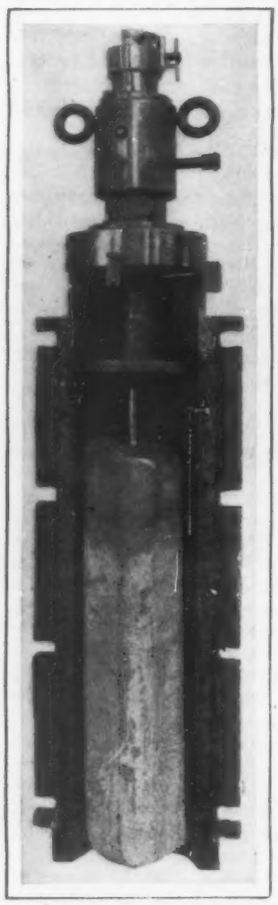


Fig. 1—A Section of the Mold with the Billet in Position

Some 50 years ago a copper-coated iron wire was made by wrapping strips of copper around an iron wire and then tinning the whole, but the product was not a success. In 1880 a bi-metallic wire was made after a process, it is stated, of casting a sleeve of copper around the middle of a steel ingot and by subsequent rolling the copper was spread in both directions on the surface of the steel, producing a rod which was afterward drawn into wire. Several other developments of processes to manufacture so-termed bi-metallic copper-coated steel followed, but were discontinued. Electro-plating steel wire with copper was also given some attention.

About 10 years ago John Ferreol Monnot, who had given the development of copper-clad steel considerable attention in France, came to this country and after exhaustive experimental work on the development of the process here described, organized, in 1905, the Duplex Metals Company, which leased and later acquired the rolling mill plant of the old Combination Iron & Steel Company at Chester, Pa. Here extensive developments in the manufacture of its copper-clad steel products, as well as improvements in methods and equipment have steadily followed until at the present time it has an entirely modern plant, particularly adapted for the manufacture of finished and semi-finished copper-clad steel materials. In the early days of the history of the concern the copper-coated steel billets did not weigh over 20 lb., but now billets weighing over 800 lb. are successfully treated.

The development of this copper-clad steel product has been along practical, rather than theoretical lines, in that each copper-clad product, instead of being theoretically estimated as to load, conductivity, service, etc., has been put to severe practical tests, before being placed on the general market. Chemistry, micro-metallurgy and heat treatment have had an important bearing on the making of the product, every step of which is controlled by definite time and temperature operations. From a metallurgical standpoint the microscope played an important part. In the photo-micrographs shown herewith, Fig, 2 represents a cross-section of a 5/16-in. steel billet, before coating with copper, while Fig. 3 shows the weld area in a longitudinal section of a ⅜-in. copper-clad steel rod.

The theory and what has also been shown to be the fact, on which the success of the Duplex Metals Company's process is based, is that an actual weld of the copper and steel takes place, not directly, but through the medium of a copper-iron alloy, the formation of which represents the first step in the process. On this alloy a commercial copper jacket is cast, which immediately associates itself with the copper-iron alloy. This is illustrated more clearly in the reproduction of a comparative corrosion test made of a copper-clad and an unwelded copper-covered steel rod. In Fig. 5, which represents the former, corrosion has set up at or near the center of the steel and has proceeded more or less slowly toward the copper, being less active at the copper contact point and forming a crater-like cavity. In Fig. 6, which represents the unwelded rod, the action of the corrosive agent set in at the point of contact of the two metals and proceeded more or less rapidly along that contact and through the steel, until the latter was dissolved. In the copper-clad rod the steel was dissolved but there also remained a honeycombed area of copper-steel alloy, which was insoluble in the reagent used for dissolving the steel. This phenomenon has been explained on the ground that in copper-clad material there is a definite union of the copper and the steel, and that certain products of this union possess properties which retard ionization and do not accelerate corrosion. In the unwelded rod there being no definite

Fig. 2 Fig. 4 Fig. 3
Fig. 5 Fig. 6
Microphotographs of Various Copper-Clad Sections

union of the copper and the steel, and therefore no other compounds being present, the differences in the polarity and potential between the copper and the steel accelerate corrosion.

The practical test as to the perfection and strength

of the welded area itself is more clearly illustrated in Fig. 4, in which it will be observed that the section of the rod shows clearly the demarcation of the copper and the steel. This has been sawed through the copper coating and into the steel, after which the various sections have been bent upward and show clearly the bending of the steel section inside of the weld area of the copper and steel.

In brief the process appears simple, including the formation of copper-iron alloy, the casting of the copper on the alloyed ingot and the heating and rolling of the ingots and the final drawing of the wire, making of nails, etc. The details at each stage of the process, however, involve no little complication in the process. The raw material, steel billets of specified chemical analysis, usually 6 x 6 x 30 in., are first drilled and tapped to admit a short rod intended to hold it in a vertical position in the mold in which the alloying and welding operations are done. It is then pickled in a bath of muriatic acid to remove scale, rust and other foreign matter, after which it is washed, preheated and maintained in a bath to prevent oxidation.

Fig. 8—The Billet Immersed in the Copper in the Crucible

The mold is of cast iron, in two sections, the billet being centered by a short coupling attached to the base of a rod, extending through the top of the mold and held in position by a three-jaw chuck. A section of the mold with the billet in position is shown in Fig. 1. On closing the mold strips of asbestos fiber are used in making a tight joint. The mold with the billet is then carried, by the overhead tramrail system, to the furnace where the first process of alloying is conducted, acetylene gas being injected into the mold to prevent oxidation of the surface of the billet before immersion in the copper bath.

The furnace, Fig. 7, is of a rotary type, lined with magnesite brick and having a capacity of 25,000 lb. of copper. Fuel oil is used for melting, the burners being located at either end of the furnace. At the center of the furnace a circular crucible is constructed, which is a part of the furnace itself, and when the furnace is in a semi-upright position it acts as an outlet for the gases and also permits the crucible to be maintained at the constant temperature of the furnace. When the ingot is ready to be treated, the furnace is rotated on roller bearings so as to bring the crucible into an upright position, the platform attached to it covering the pit at the floor level, Fig. 8. The position of the furnace is shown in Fig. 9. The billet with its attached flange is lowered from the mold into the crucible containing the melted copper, the length of immersion being governed by the temperature and the time necessary for the formation of the alloy. On removal from the bath the mold and the ingot are carried on the same overhead tramrail system to another rotary furnace, where commercial copper is maintained at a definite temperature. After the ingot and the mold are set on a base block, designed to hold the ingot and mold in a relative vertical position at the base, molten copper at a predetermined temperature is poured into the mold by plumbago crucibles and unites with the alloyed surface of the billet. After cooling the molds are stripped from the copper-coated ingots, and the latter are placed in the specially constructed, continuous heating furnaces shown in Fig. 10. These furnaces, which are open at both sides, are top fired with fuel oil, the direction of the flame and the heat being

Fig. 7—The Rotary Furnace Containing a Bath of Molten Copper in an Upright Position

downward through openings in an arch extending across the furnace. The floor of the furnace is checkered, so that an even distribution of heat is maintained throughout. The billets are laid on water-cooled pipes, extending above the bottom of the furnace, thus providing for an even distribution of heat throughout the billet. From

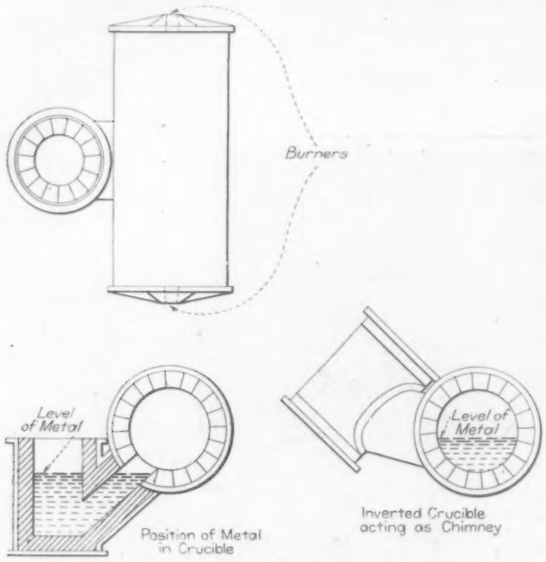


Fig. 9—Details of the Melting Furnace

the heating furnace the billets are carried by overhead tramrail systems to the various mills for rolling to the desired shapes and sizes. The rolling practice is similar to that of steel and it is interesting to note that notwithstanding the differences between the physical properties of the copper and steel, the two metals, when welded by this process, flow practically as one and the proportional areas of the copper and the steel remain practically a constant from the larger to the smaller passes.

Considerable attention has been given to the metallurgy of copper-clad steel by Wirt Tassin, until recently metallurgical engineer for the Duplex Metals Company, who in an article in *The Iron Age*, June 9, 1910, referred particularly to the micro-metallurgy of this product.

Physical constants for copper-clad wire of 40 per cent. conductivity have been determined by various authorities. A mean of twelve samples submitted to the Ordnance Department of the United States Army, at the United States Arsenal, Watertown, Mass., was as follows:

True elastic limit, lb. per sq. in	50,625
Johnson elastic limit, lb. per sq. in	66,675
Modulus of elasticity before stressing, lb	21,460,000
Modulus of elasticity after stressing, lb	22,637,500
Tensile strength after repeated stresses, lb	90,275

As the value of copper-clad products for mechanical purposes lies in the strength and non-corrosiveness, only that amount of copper necessary to prevent rust is required. Two things affect the relative proportions of steel and copper: the size of the finished product and the use for which it is intended. Regardless of any other condition there must be a minimum thickness of copper covering the steel. For electrical use, strength and resistance must be considered, whether a small wire of 30 per cent. conductivity, or a larger one of 30 per cent. conductivity, or one of 40 per cent. would best serve. The Duplex Metals Company makes regular grades of 30, 40 and 47 per cent. conductivity solid copper wire. As the

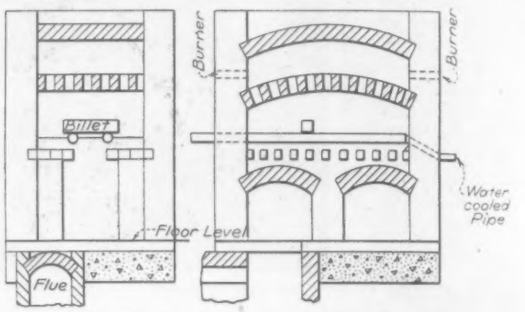


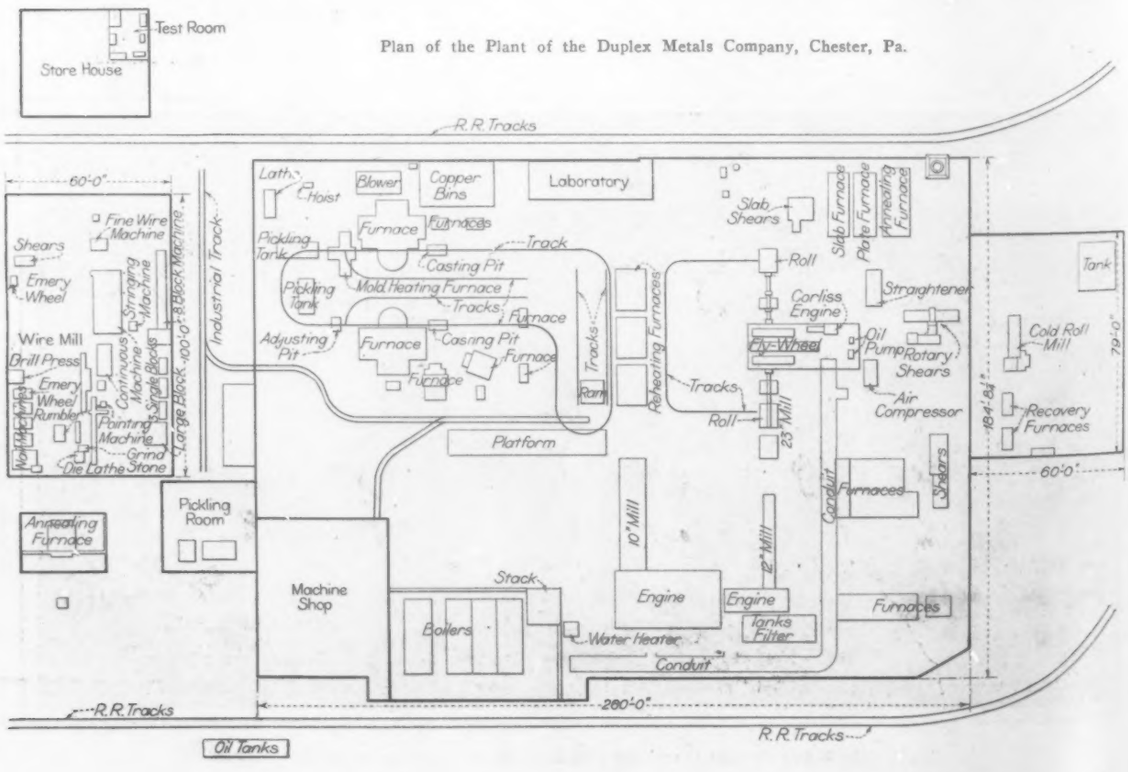
Fig. 10—Details of the Heating Furnace

drawing of copper-clad wire requires special knowledge, particularly as to correctness of the shape of the die, proper lubricant, speed, annealing points, etc., all the wire is drawn under its own direct supervision to the Brown & Sharpe gauge.

The Plant

The plant, a plan of which is reproduced in Fig. 11, is located on the Delaware River front at Chester, Pa.,

Plan of the Plant of the Duplex Metals Company, Chester, Pa.



occupying a site of 11 acres. The buildings which, when the plant was acquired, were all of frame construction, have been entirely replaced with structural steel frame structures. All the equipment is modern. Electricity is used almost exclusively for power purposes, and the output of the plant, as now equipped, equals 25,000,000 lb. annually.

The rolling mills and metallurgical and mechanical departments are grouped in one main building, measuring 184 x 260 ft., with a 60 x 79-ft. extension at one end. Railroad sidings extend across one end and along both sides of the building and also to the wire, nail and other departments at the rear of the main building. The metallurgical department is at the rear of the main building. Here are received the crude steel billets, which are unloaded by an electric crane, and the machinery for drilling and tapping them, the pickling tanks, the mold heating furnaces and the platforms for adjusting the billets to the molds are conveniently placed. An overhead tramrail system carries the molds to the rotary melting furnaces for alloy treatment. Two 25,000-lb. rotary furnaces are provided, each with an independent fuel system, using electrically-driven positive pressure blowers, which are so arranged, however, that they can be used with either furnace, should there be any breakdown in the system. These furnaces are entirely covered with heavy sheet-iron casings, carrying the heat outside the building. Adjacent are two 10,000-lb. plain rotary type furnaces for melting the copper for casting on the alloyed ingot. An overhead tramway system carries the copper-clad billets from the mold stripping floor to the heating furnaces, where a mechanical charging machine charges them into the heating furnaces, which are located adjacent to the 23-in. mill rolling 8 x 8-in. billets down to 4 in., which is shown in Fig. 12, and the 60-in. plate and sheet bar mills, which are driven by a Corliss rolling mill type engine. Furnaces for heating slabs and plates, an annealing furnace, rotary shears, straightener and slab shears are located conveniently near the mills. A cold-roll mill is located near the upper end of the building. In connection with this mill, portable coiling, slitting, slotting and shearing machines are used, each being placed in position before the mill, according to the class of work to be done. At this point are also located the pickling tanks and other equipment necessary for cold rolling. A battery of small rotary melting furnaces used for the recovery of copper from scrap is also situated near by.

The 10 and 12-in. mills for rolling a 4-in. square billet down to ⅜ or ½ in. illustrated in Fig. 13 have their own battery of heating furnaces. Adjacent to the 10-in. mill is the stock platform to which is delivered wire rods, etc., for transportation to the wire drawing or other departments. An industrial railway reaches practically every department of the plant from this point. The 12-in. mill is driven by a Porter-Allen and the 10-in. mill by a Buckeye engine. The steam power plant for the mill engines comprises a battery of three 250-hp. engines and is located close by the rolling mill department. An efficient system of overhead cranes serves the rolling mill department. A bridge crane covers the 23-in. and the plate mills; electric jib cranes serve the various furnaces, tanks, etc., while a complete system of industrial railway tracks facilitates transportation in every department. The laboratory is located at the right of the metallurgical department, while the machine shop, which contains the usual complement of machine tools, is situated in one corner of the plant together with the electrical department and the pipe fitting and other mechanical repair departments.

Fig. 12—The 23-In. Mill for Rolling an 8 x 8-In. Billet to 4 In.

The wire drawing department Fig. 14, is located at the rear of the metallurgical department, occupying a building which, including the annealing and pickling rooms, measures 60 x 100 ft. The wire mill equipment is of the usual type, specialized in some instances for the particular class of work, large blocks, single blocks, continuous machines, straighteners, etc., being advantageously grouped. A number of nail machines utilize the short lengths of wire in the manufacture of the various sizes of copper clad nails.

Fig. 13—The 12 and 10-In. Mills for Reducing a 4-In. Billet

Fig. 14.—A View in the Wire Department

Adjacent to the wire mill is the storage and shipping room and a testing room, where previous to shipment every coil of wire is tested for conductivity and gauge by representatives of the Wire Inspection Bureau of New York.

In close proximity to the main manufacturing buildings are located the blacksmith shops, storage rooms and various other buildings. At one side is a battery of crude oil storage tanks, having an aggregate capacity of 100,000 gal.

Inspections play an important part in the manufacture of copper clad products, every billet being inspected for surface finish. Each bar and finished rod is inspected and all of the former are designated by serial numbers, which are carried throughout the various stages to the finished coil of wire. Careful inspection is made of a sample from every coil of rod for perfection of surface and weld before it is delivered to the wire drawing department.

The various wire products in which the Duplex Metals Company specialize include electric transmission wire, nail wire, bond and signal wire, cotter pins, springs and series are and incandescent wire. Insulated and waterproofed wire are also made with a copper coating, although the company does not include the covering of the wire in its line. In addition to the wire lines it manufactures copper-clad strips and sheets, the latter up to 54 in. wide, and small shapes up to 3-in. angles and channels. A very considerable portion of its product is being exported, going to both Continental Europe, England and the South American countries. A stock of 300,000 to 500,000 lb. of copper and the same quantity of steel billets is carried as well as copper-clad steel bars, wire rods and semi-finished materials.

The Engineers' Society of Western Pennsylvania held its opening meeting for the season of 1912-13 last week in its rooms in the Henry W. Oliver Building, Pittsburgh. A paper on the "Ohio River Highway Bridge at Sewickley" was presented by V. R. Covell, deputy county engineer of Allegheny County.

The Duncannon Iron & Steel Company, Duncannon, Pa., has put its 12-in. mill and puddling furnaces on double turn.

A Portable Electric Drill Test

The following report on a series of tests made by the University of Cincinnati on a ½-in. electric drill manufactured by the Standard Electric Tool Company, Cincinnati, Ohio, shows a remarkable performance:

Data of Test on Standard ½" 110-Volt Portable Electric Drill

Test number	Volts	Watts	Size of drill	Depth of hole	Time in seconds	Material
1.....	95	*	½"	2"	52	Steel
2.....	110	450	½"	2"	67	Steel
3.....	120	650	½"	2"	35	Steel

*The watts of the first test varied owing to the varying load on drill, as the feed was too rapid to be regular.

Test performed by A. H. Stewart. Attested to by A. M. Wilson, professor of electrical engineering.

These tests were made by placing the electric drill in an upright position under the spindle of an upright drill press, and the press feed used to force the drill against the work.

Tests Nos. 1 and 3 were made under the most unfavorable circumstances met with in electric drill practice. Test No. 1 was made at a low voltage and the drill was worked extraordinarily hard, and test No. 3 was made at an abnormally high voltage and the drill again worked much harder than it would ever be possible for it to be worked in actual practice. In either of these cases the drill was not damaged in the least, either by the high mechanical strains or by overheating. Test No. 2 was made under normal conditions both as to voltage and load applied to the machine, approximating as nearly as possible to operating conditions where the tool would be in continuous service.

The time required to drill a ½-in. hole through 2 in. of steel is quite noteworthy in the above tests, which show that at even the reduced pressure of 95 volts it can be made to drill at the rate of 1 in. in 26 sec.

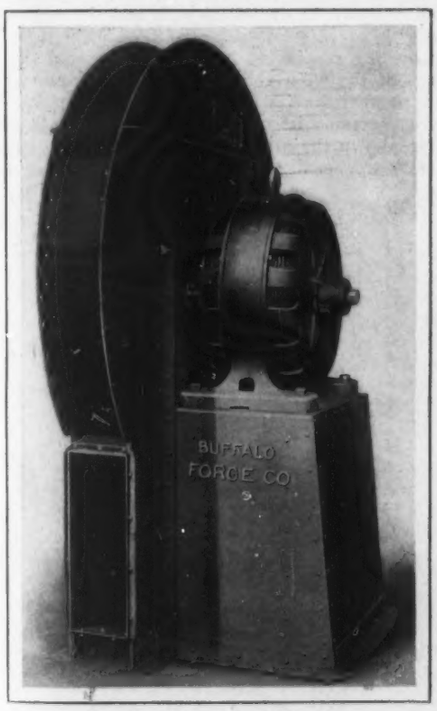
The Rateau Steam Regenerator Company, 140 Cedar street, New York, has granted a license to the Ingersoll-Rand Company to manufacture the patented Rateau regulator for mixed flow turbines. The General Electric Company, the Southwark Foundry & Machine Company and the Ridgway Dynamo & Engine Company have been for some time manufacturing under a similar license from the Rateau Steam Regenerator Company.

Motor-Driven Forced Draft Blower

A striking example of the simplicity and efficiency of operation of a motor-driven blower for furnishing the air for furnaces and forges is clearly brought out by the equipment installed several months ago at the plant of the Merchant's Dispatch Transportation Company, East Rochester, N. Y. The blower consists of a No. 10 steel plate special type blower, built by the Buffalo Forge Company, Buffalo, N. Y., and directly connected to a 75-hp. type CCL Westinghouse induction motor.

Formerly the company used a belt-driven outfit for supplying air to a large number of oil burning furnaces, as well as for burning crude oil in the forges where the iron is heated for forming and bending and welding in the construction of the cars built at this plant. Considerable trouble was experienced, due to breakage and slippage of the belts and on account of the lack of floor space, both the blower and the motor were placed up in the roof trusses. As compared with the old outfit, the present motor-driven outfit occupies so little space that it could be installed in a much more desirable and advantageous position, and by reason of the absence of all belts, trouble due to shutdowns on account of them was eliminated and the service has been satisfactory. The air is delivered at a pressure of 8 oz. per sq. in., and the oil at a pressure of about 5 lb., this being obtained by placing the oil in a large overhead tank.

The blower is of the steel plate pressure type and has a capacity of 10,000 cu. ft. per min. at a pressure of 11 oz. per sq. in. The whole unit is built to resist the strains of high pressure duty, such as are encountered in delivering large amounts of air, and the housing is built



A Motor-Driven Blower Supplying Forced Draft to a Number of Oil Burning Furnaces in the Plant of the Merchant's Dispatch Transportation Company Built by the Buffalo Forge Company, Buffalo, N. Y.

of heavy gauge steel plate securely riveted and bolted together and further reinforced by an angle-iron frame. Heavy steel plate is also used for the blast wheel, which is mounted upon a malleable-iron spider. The vanes are riveted to the steel plate flanges and the principal ones are also riveted to the spider arms. Power for driving the fan is transmitted from the squirrel cage rotor of the motor to the spider of the fan through a direct connection consisting of a special design of flexible insulated coupling. The base which supports both the blower and the motor is built of heavy steel plate with angle-iron reinforcing.

The motor is of the constant-speed induction type and is designed for operation on a three-phase, 60-cycle, 220-volt alternating circuit. The full load speed is 1120 r. p. m. and the capacity is 75 hp. This is greater than is necessary to deliver the rated output of the fan, but this size of motor was selected because of the fact that more air is sometimes needed for the furnaces. The capacity of the outfit is 14,000 cu. ft. of air per min.

The New Ohio Constitution

A number of important amendments to the constitution of Ohio were adopted at a special election held in that State September 3. Forty-one amendments were voted on separately and practically all were approved by the voters. The only amendment that met with overwhelming defeat was one giving women the right of suffrage. The amendments were in line with sentiment that has been cropping out for some years, and a vigorous campaign was conducted in their behalf, in which labor organizations took an active part. Amendments adopted that particularly affect employers and labor were as follows:

Giving the Legislature authority to pass a compulsory workmen's compensation law. A workmen's compensation law was enacted by the last session of the Ohio Legislature and is now in effect, but it does not compel employers to contribute to the State insurance, the Legislature not having power under the old constitution to enact a compulsory compensation law.

Providing an eight-hour day for workmen engaged on any public work carried on or aided by the State or any political subdivision thereof, whether done by contract or otherwise.

Giving the Legislature authority to pass laws to regulate the hours of labor, establish a minimum wage and to provide for the comfort, health, safety and general welfare of all employees.

Providing that the amount of damage recoverable by civil action in the courts for death caused by the wrongful act, neglect or default of another shall not be limited by law. At present the amount of damages that can be recovered in such cases is limited by law.

Giving the Legislature authority to pass laws regulating proceedings in contempt and limiting the power of the courts to punish for contempt. A paragraph of this section deprives the courts of the right to issue orders of injunction in any controversy involving the employment of labor except to preserve physical property from injury or destruction. This prevents the issuance of an injunction to prevent personal violence during strikes and other labor disputes. All persons charged in contempt proceedings with the violation of an injunction are granted the right of a trial by jury. At present the court judges decide on the guilt or innocence of the accused in contempt proceedings.

Making compulsory the abolishing of prison contract labor. This section permits the employment of prisoners in the production of things needed by any county, State or municipal institution, or in the building of public roads.

Among other of the most important amendments adopted was one establishing the initiative and referendum.

September 4 was the thirtieth anniversary of the beginning of commercial incandescent lighting. On September 4, 1882, Thomas A. Edison started in operation the world's first central station. At three o'clock in the afternoon, in an old brick building, a converted warehouse, in lower Pearl street, New York, steam was turned into a single dynamo and current was sent through underground cables into about 400 lamps distributed throughout a territory of a square mile, bounded by Wall, Spruce and Nassau streets and the East River.

The net surplus of freight cars on the railroads of the United States and Canada as reported by the American Railway Association was only 9750 on August 29, as against 43,901 two weeks before. There were net shortages of 3768 in box, flat and coal cars and a net surplus of 13,518 in all other cars.

Test Bars for Chillable Cast Irons*

A New Method for Determining Contraction, Deflection and Strength in the White and Gray States of the Same Metal

BY THOMAS D. WEST

This paper presents an original system for making comparative tests of the relative contraction, deflection and strength of chillable cast iron in both of its distinct forms: all-chilled or white, and all gray. The writer, for the past two years, has been experimenting with chillable irons in foundries making a specialty of chilled castings, and this has led him to see the great importance of a test system which can show the relation between the physical properties of the white and gray states of the same metal, especially for such castings as chilled car wheels and rolls. The system presented herein was originated not only for the purpose of creating methods of studying and possibly improving the ductility and strength of the white iron, without impairing the gray or mottled from the same tap or ladle of metal, but also to offer a system that might lead to the adoption of some standard for testing chillable irons.

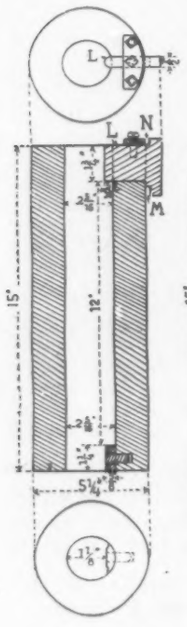


Fig. 1

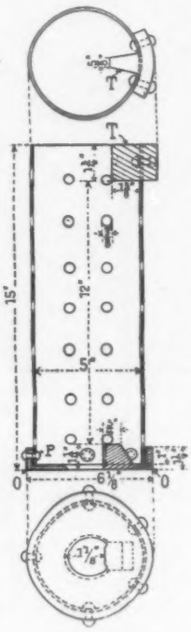


Fig. 2

Design of Chiller and Flask for Obtaining the White and Gray of Chillable Iron

Until some practicable form and size of test bars for chillable irons and methods for making them are adopted as a standard, a person desiring positive knowledge will obtain little satisfaction in any study of test records or in making comparisons of his own findings with those of others.

Round Bars Cast On End

The first important factor in the system advanced herein is the use of round bars cast on end in preference to square bars cast flat. The round bar cast on end, aside from offering the greatest assurance of solidity at the point of fracture when broken, gives a form that is the least affected by variations in the pouring temperature of metal, dampness and grades of sands and irregularities of the molder's manipulations in the general work of making test bars. With reference to soundness, it is to be said that few things are more aggravating, after expending much care and labor in testing bars, than to find the fracture showing shrink holes, blow holes or sand holes.

Objection has been made by some to round bars, because they do not afford good bearing points to rest them on for testing purposes. The three-point bearings seen at A, B and C, Fig. 9, remove these objections and in reality furnish a better means of support than those now used with unfinished or rough square bars. The three-point support guards against torsional strains in the testing of either finished or rough test bars.

*Presented at the Sixth Congress of the International Association for Testing Materials, New York, September, 1912.

Obtaining the Contraction

Much study was given to devising means of guaranteeing correctness in obtaining the vertical contraction of the test bar. This is measured by calipering the distance

Fig. 3

Fig. 4

Fig. 5

Cores, Fork Wedge and Device for Forming Projection on Gray Bar

between the shoulders D and E (Fig. 8) for the gray bar and between shoulders F and G (Fig. 9) for the white bars, and subtracting from the original distances the shoulders J—K and H—I (Fig. 6). Should contraction records not be desired then the provisions for these measuring points could be dispensed with and the chiller be a plain body.

In providing measuring points for obtaining the contraction with the solid chiller, Fig. 1, it is necessary, in order to remove the test bar, that one of the shoulder-forming projections be taken out or pulled back. With the design shown the arm L is drawn backward by driving the fork wedge, Fig. 4, in the space M—N, Fig. 1. To

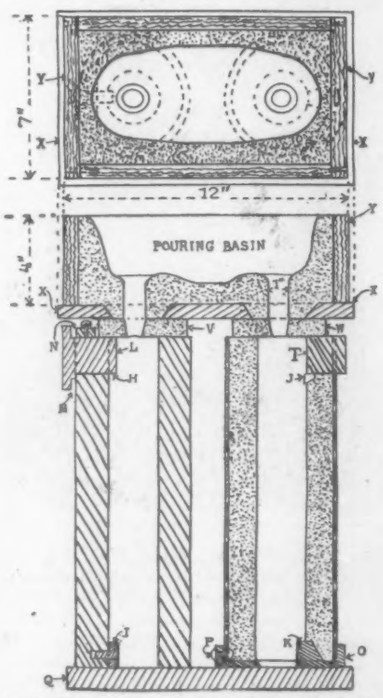


Fig. 6—Chiller and Sand Mold Ready for Casting

arrange for making another bar the arm L is pushed back to the position shown.

In arranging to obtain the contraction for the all-gray test bars a bottom plate O, Fig. 2, is riveted rigidly to a 5-in. wrought pipe P. A bottom plate of the thickness shown should be made of steel; if of cast iron it would be made thicker. The under face of this bottom plate should be machined so that it can set level and firm on the

foundation plate Q, Fig. 6; similarly the bottom of the chiller should be machined. This will prevent the forming of any fins on the bottom of the test bars when pouring the mold, as these, especially in the case of the white bar, might cause checks to injure it.

In forming the projection seen on the gray bar at R,

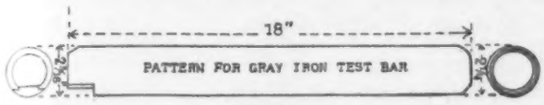


Fig. 7

Fig. 8, and at J, Fig. 6, the device seen in Fig. 5 has its point S pressed into the sand, after drawing out the test bar pattern, by sliding it over the stationary rigidly riveted headpiece T, Figs. 2 and 6.

After the contraction shoulder points are firmly secured in their positions, to be as near 12 in. apart as practical, exact measurements of their distance to the hundredth of an inch should be recorded. This is necessary in order to obtain the correct contraction.

Making Comparisons of Round with Square Bars

To determine the proper size necessary for the round bar some experimenting was done. It was found that a 2¼-in. round bar should serve all general purposes for chillable irons containing from 0.50 per cent. to around 0.90 per cent. silicon, in combination with such total carbon, sulphur and manganese as generally used for chilled castings. Such silicons are within the range of practically all deeply chilled castings, especially car wheels and rolls. A bar of 2.267 in. diameter is equal in area to a 2-in. square bar. This size of a round bar, roughly described as 2¼ in. diameter, can be well utilized in making comparisons with any 2-in. square bars that may be found advisable for conducting any special investigations.

The size of 2 5/16 in. given for the diameter of the bore of the solid chiller, Fig. 1, allows closely 3/64 in. for the horizontal contraction of the white bar test. This contraction will permit an easy removal of the test bar from the solid chiller.

Designs of Chillers to Give White Iron Test Bars

For obtaining all-chilled or white test bars, a chiller or all-metal casting mold has to be employed. In obtaining the white bars for the author's experiments, the chillers used were made in halves and bolted or clamped together. Even with the best of machining and care in fastening these together, there is more or less risk of obtaining fins on the test bars. These fins can cause chill cracks or invisible ruptures, and thus often prevent a bar recording its full strength or deflection when being tested, by reason of the fins retarding the natural contraction of the metal. The author's experience causes him to recommend the solid chiller seen in Fig. 1 as being the best for general use. Such a chiller may be obtained by boring out a cored iron or steel casting, made in a manner giving a perfect, clean and solid bore; and again by boring out a solid shaft, which should serve the purpose even though ½ in. less or more in outside diameter than given in Fig. 1.

To reduce the risk of obtaining an imperfect bore, the chiller might be made in two or three sectional lengths, having male-and-female seats and close-fitting joints. In making such sections no joint should be within two inches of the plane at which a bar is liable to break when being tested. This plan of a sectional chiller would permit its upper end being constructed the same as that seen for the

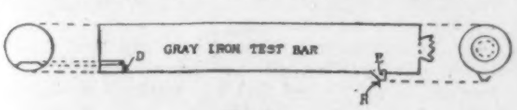


Fig. 8

lower end of Fig. 1 and would avoid the necessity of having the removable piece L, Fig. 1, and the forked wedge, Fig. 4.

Pattern and Mold for the Gray Iron Test Bars

The wooden pattern (Fig. 7) is made 18 in. long, in order that 3 in. of its upper end may serve for a handle to draw the pattern. The lower end of the pattern is made of the same form as the inner construction of the bottom plate O (Fig. 2).

The top of the pattern as seen is 2¼ in. in diameter and the bottom 2 3/16 in., to give taper for drawing it. The mean diameter of this pattern, although about 3/32 in. smaller than the chiller mold, gives a gray bar closely the same size as the white one. This is due to enlargement of the mold by rapping the pattern, to ease it for drawing, and the hydrostatic pressure of the metal straining the mold, and also to the difference in the horizontal contraction of white and gray bars of the same metal.

The outside support for the sand mold being all iron permits the mold being either dry sand or green sand; but if the latter, care must be exercised in always having closely the same temper of sand and ramming it evenly, so that there will be no swells on the test bars. In cases where comparison of the white with the gray involves the detection of minute changes, or the silicon is below 0.70 per cent., the mold is best made of dry sand. This is also advisable should novices have to be intrusted with the making of the mold.

The 5-in. wrought pipe, having ⅜-in. holes, takes care of venting the mold. The chiller must be kept free from rust and never moistened with water, and an occasional rubbing of its inner surface with a very light coat of thin oil or regular car wheel chiller varnish is advisable.

Pouring the Bars

The chiller and sand mold having been prepared they are placed on the base plate Q, Fig. 6, care being taken that there is no fine grit or dust to prevent a close jointing of the two bodies, so as to avoid the formation of fins at the lower end of the bars. When the chiller and sand mold have been placed, cores as shown by Fig. 3 are set as at V and W in Fig. 6. An iron plate X is placed as shown, after which gate sticks are set in the holes of the cores V and W and the runner box Y placed in position. The pouring basin, formed of green sand, should be of

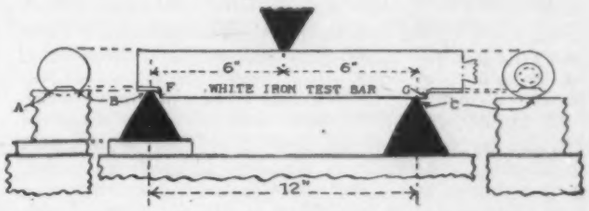


Fig. 9

good size so as to hold a fair body of metal. When starting to pour the mold the pouring basin should be quickly filled to prevent any dirt or scum from flowing with the metal into the molds.

The pouring gates are but 1 in. in diameter in their main body. Their smallness helps to prevent dirt passing to the mold and also makes them easy of being broken off in cleaning the test bars. Their small size is very liable to permit the creation of small shrink holes in the tops of the bars. This being no serious defect it is better than having the gates sufficiently large to absolutely prevent such holes and cause the risk of injuring the bars when breaking off the gates. A small feeding-rod could be employed to feed the mold and make the tops of the bars solid, but to use this successfully requires considerable experience. A 1¼-in. pouring gate could be used, especially for the all-chilled bar, to reduce the chance of shrink holes forming. In this case, however, care must be used in skimming and in knocking off the gates.

While two molds are shown, as in Fig. 6, to be poured from the same basin for the purpose of insuring exactly like temperatures of metal in both molds, there are many cases where they could be poured independently of each other. In pouring the molds separately, with the same ladle, they can be so close together as to cause but a difference of five to 10 seconds in pouring them. In pouring one mold after the other the cores (Fig. 3) could have their tops made of a cup-form, to thereby give a small pouring basin to connect with the inlet gate. Again to simplify the work these top covering cores could in some cases be omitted and the metal poured directly from the lip of the ladle into the molds. In this instance care is necessary to prevent the dropping metal from striking the

sides of the molds, or filling them any higher than within ¼ in. or ½ in. of the top, so as to guard against an overflow making fins on top of the bars.

The system advocated herein is formulated from actual experiments in regular shop practice. The chillers used in these experiments, made after the writer's designs, were kindly furnished him by H. E. Smith, engineer of tests for the Lake Shore & Michigan Southern Railroad, Collinwood, Ohio. For chillable metal and for the opportunity to test the system credit is due to the liberality of the National Car Wheel Company, Cleveland, Ohio.

A paper showing the utility of the above system of tests and entitled "Researches in and Tests of Chillable Irons" was presented by the writer before the American Society of Mechanical Engineers at Cleveland, Ohio, May, 1912.

[In Mr. West's paper before the American Society of Mechanical Engineers, to which reference is made in the concluding paragraph above, he gave the results of extensive work in the chilling and hardening of cast iron, most of it carried on at the plant of the West Steel Casting Company, Cleveland. He gave details of methods of producing "inside chills" by mechanical means. In these the outside of the casting is allowed to cool slowly enough to let the carbon take the graphitic form, while the inside is cooled so rapidly that the carbon is in the combined form. The author's conclusion is that the tests indicate two laws: first, that the process of chilling is effective for a period of 20 or 30 seconds after the molten metal has solidified; second, that graphitization having once taken place in the crust or body of a casting, the carbon cannot be restored to its original combined form except by remelting.—ED.]

The Congress on Testing Materials

The Proceedings of the Meetings Last Week in New York City of the International Association for Testing Materials

A meeting of potential importance to the commercial progress of nations was held last week in New York City. It was the sixth congress of the International Association for Testing Materials. It brought out considerable information regarding methods and apparatus for testing materials for construction; it extended knowledge of the properties of materials and paved the way toward such matters as the erection of international specifications. The growth of the association has been exceedingly rapid and this very fact has actually checked the consummation of some lines of work which leaders in the association hope to accomplish. In short, the scope of the association, both as regards subject matter and as regards increased membership in a widening area of civilized nations, emphasizes the difficulties of attempting to secure agreement at this time on definitions, specifications, and even testing methods applicable to all. This fact arises from the different manufacturing processes existing in different countries. It is the belief that at least in the direction of the iron and steel industries, the influence of the association will be to unify manufacturing processes or bring them more nearly together, so that methods of testing and requirements of specifications can be recommended with less disturbance to international commerce than, it is felt, would be the case to-day.

The congress stands, however, as a meeting the importance of which will become apparent by the time the next congress is assembled in September, 1915, in St. Petersburg, Russia. Though it did not discuss an international iron and steel specification outside of the committee, it adopted a resolution proposed by the committee to proceed further with the collection and dissemination of information concerning such specifications in different countries, and it continued the work of the committee attempting to settle on nomenclature of iron and steel. It recommended standard definitions relating to microscopy of iron and steel, and it offered considerable in the way of recommendations covering reinforced concrete construction, cement and the fireproofing of buildings. The sentiment was expressed here and there that the congress was unsatisfactory, if at all, because of the large number of papers offered, making it inconvenient to attempt discussion, and from lack of time requiring the submission by title of some of the papers and at least one important report of interest to a large percentage of the participants. The necessity of using three languages aggravated the conditions imposed by the long programme, but after all it is recognized that the most important work of the association is done by its committees and they now have the further advantage of personal contact with more of their co-workers.

The attendance was about as large as expected, the registration in the American section totaling close to 500, while the foreign registration probably amounted to about 250, making the total attendance more than 700. At this writing a large percentage of the visitors from abroad are enjoying a tour taking them to Washington, Pittsburgh, Buffalo and Niagara Falls. This party numbered over 230 and required three special Pullman trains. For this journey and other tours planned merely for the convenience of those in a position to spend more than the present week in the United States, a souvenir book of 150 pages generously illustrated and bound in a flexible suede leather cover was given to each visitor, describing the points of interest in the cities along the routes.

As suggested in last week's issue, Prof. Dr. Ing. Nicholas Belelubsky, professor emeritus of the Institute of Engineers of Ways of Communication of Emperor Alexander I, St. Petersburg, was elected president, and the invitation tendered by the Czar through him to hold the next congress in St. Petersburg was accepted. While no invitation was received with regard to the congress six years hence, it is thought that it will be held in London.

Last week's report reviewed the proceedings briefly, practically to the end of Wednesday morning's session of Section A, devoted to metals. Sessions of the metal section were held on Thursday morning, two simultaneously on Thursday afternoon, and on Friday morning and afternoon, while on Saturday morning the congress convened in a general closing session, when the numerous resolutions reported by the resolutions committee were all adopted. The entertainment programme provided for receptions and visits to places of interest in the vicinity of New York, and included a water trip on a chartered steamboat to the Government military school at West Point. Early on Sunday afternoon the visitors left for Washington on the official tour.

Tests for Pipe

Among the papers presented on the Wednesday morning session, after the submission of the resolution reported last week respecting international iron and steel specifications, was one by Prof. Gaetano Lanza, Philadelphia, on the progress in the United States in testing full size pieces under practical conditions and on locomotive testing, and two papers relating to pipes: one by Charles Fremont, of Paris, France, and the other by A. C. Karsten, of Copenhagen, Denmark. Mr. Fremont's paper described a new testing method for steel tubes and suggested the application of the notched-bar impact test to tubes. A narrow ring of the tube is flattened, doubled to U-shape, notched by a saw cut, and tested in the Fremont machine; it should give at least 16 kgm. per sq. cm. initial sectional area. Mr. Karsten's paper opposed the criticisms advanced by

Mr. Fremont to the specifications for steam, gas and water tubes drawn by the Association of Danish Engineers in 1909. The newly proposed Fremont test for tubes, involving cutting off a narrow ring at the end and testing it by an impact test, is inapplicable, he held, to this class of tubes because their ends are threaded.

F. N. Speller, metallurgical engineer of the National Tube Company, in discussing Mr. Fremont's contribution, held firmly to his claim that the methods followed at the American pipe mills for testing pipe was the best. The practice he has developed, it will be recalled, was described in a paper presented by him last year before the American Society for Testing Materials. He emphasized that lap welded tubes performed unquestioned service where seamless tubes were regarded abroad as essential. He argued for the hydrostatic pressure test at the mills and claimed that an important consideration in tube making is not so much the volume of the weld or lap as the quality of the weld.

Tensile-Impact Tests

At the meeting of the metals section on Thursday morning, the first paper taken up was that of N. Davidenkof, engineer of Ways of Communication, St. Petersburg. This paper, a theoretical study of a tensile-impact machine, is in abstract as follows: In tensile-impact testing machines in which the test piece falls with the ram, if the rupture-work is computed as equal to the kinetic energy of the lower ram an error is introduced which sometimes exceeds 50 per cent. This error arises from neglecting the energy abstracted from the upward motion of the rebounding upper ram. By tracing the curve of motion of the upper ram on the same diagram with that of the lower ram (in Hatt's method of determining the rupture-work), the correct energy loss may be obtained. The author prefers to accomplish the rupture without impact on fixed masses, by utilizing the impact of two rams moving in opposite directions, the testpiece tying the rams together. One method of accomplishing this is to suspend the lower ram from the upper by thin cords, free from the testpiece, so that the upper ram will rebound and be moving freely upward before the impact of the lower ram on the testpiece occurs; then the energy-loss of both rams may be deduced from their fall curves drawn by attached pencils.

Prof. W. K. Hatt in a short discussion of the paper brought out that a large increase in the mass of the lower tup, relative to the mass of the upper tup, reduced the error mentioned in the paper to a very small quantity. E. B. Wolff described a machine which gave good results and concluded his discussion with a description of the test of a steel ingot which had been heat treated. Defects were revealed by the notched-bar impact test which had not been shown by any other method. He recommended that the notched-bar impact test be combined with microscopic and tensile tests, which he thought would give complete information concerning the structure of the metal under test. Dr. Walter Rosenhain spoke a word of caution against the reduction of the mass of the upper tup to too great an extent relative to the mass of the lower tup, as work will then be done in producing deformation of the upper tup, thus introducing errors quite as serious as those due to the energy absorbed in the rebound.

General Discussion on Impact Tests

At the conclusion of the discussion of Mr. Davidenkof's paper, a general discussion on the entire subject of impact tests, which had also been postponed from the Tuesday afternoon session, ensued. Dr. Archibald Denny, Leven Shipyard, Dumbarton, Scotland, said that while the impact test was a highly desirable and valuable one, yet the papers which had been presented at the congress showed such wide differences in methods and results that there could be no certainty that a definite conclusion as to the exact course to be pursued in impact tests had been reached. The impact test could at this time be safely considered only as in process of investigation.

Henry Souther, Hartford, Conn., agreed with Dr. Denny that the time was not yet ripe for the adoption of a standard impact test. "Yet it is a test of great value if it is possible to standardize it. It appealed to the manufacturer because it is a test which may be quickly applied and which reproduces to a high degree the conditions which the metal under test will encounter in service." He agreed with other speakers that the investigation of the impact test should be continued and thought that as a start toward standardization the bar proposed in a resolution by Prof. A. Mesnager, chief engineer Bridges and Roads, Paris, France, namely, 10 x 10 mm. section, 20 mm. between supports, should be adopted. He also asked that in connection with impact tests the size of grain in the fracture should be investigated. His experience had been that a large grain fracture gave a poor impact, while a fine-grain fracture gave a good impact result. The test is of great importance for springs, axles, gear teeth, etc. Prof. Heyn objected to the adoption of the resolution proposed by Prof. Mesnager on the ground that a resolution of similar character adopted at the fifth congress had nullified all previous work of the committee.

Endurance Tests

A group of papers relating to endurance tests had been prepared for the congress, but as no papers were read in the meetings unless their authors were present at the congress, only two of these, both being by J. O. Roos, director Royal Testing Institute, Stockholm, Sweden, were presented. The first of these, entitled "Endurance Tests of Machine Steel," brought out that many broken machine parts studied by the author showed obvious fatigue fracture, and that testing metals for endurance is considered essential. Revolving-beam experiments are preferred, a form of specimen being suggested. Repeated-impact strength must also be considered in selecting machine materials, and is not necessarily proportional to ordinary endurance strength, though one series of experiments indicated such proportionality. Usually the requirements of resilience and endurance must be compromised, with chief regard paid to the latter.

The second paper was entitled, "Some Static and Dynamic Endurance Tests," and in it endurance tests of cantilever testpieces in rotary bending were described. A testpiece is recommended (10 mm. by 100 mm. long to back of fillet). The influence of the radius of the fillet is found to be small. Such tests are not regarded as suitable for specification tests. An impact endurance test was arranged by fixing the testpiece vertically and arranging two pendulum hammers to strike the free end on opposite sides, with definite hight of fall and at a fixed speed of repetition (50 pairs of blows per min.). The maximum stress being computed on the assumption of no loss by local dissipation, the stress can be plotted to an abscissa of number of repetitions for fracture. One group of tests on 0.65 per cent. carbon steel gave points lying practically on the endurance curve obtained for the same material in the prior rotary-bending tests.

Both papers were discussed as one. Dr. Walter Rosenhain called attention to a test in which a notched piece supported at each end was revolved through 180 deg. and struck a blow with a hammer which was automatically released at the proper moment, revolved through another 180 deg. and again struck, and so on until the limit of endurance was reached. He said that the results obtained in this test depended largely upon the weight of the hammer, one of excessive weight approximating the results of the simple notched-bar impact test previously discussed. He cautioned against the abuse of the endurance test which could be made to give almost any desired results in the hands of incompetent persons.

In regard to the elastic limit of the material under test, the speaker said that this term seemed to have different meaning in different countries, and he emphasized the necessity of arriving at a common meaning if the work of different experiments is to be compared. Prof. Rejtö called attention to a formula for endurance tests which he had presented in a paper at the Copenhagen congress. He did not care to burden the meeting with the derivation of the formula, but would have it incorporated in the proceedings of the present congress.

Magnetic and Hardness Tests

Two papers were presented to the meeting which considered the relation of the electrical and magnetic qualities of steel to the other properties. The first of these, by C. W. Burrows, assistant physicist, Bureau of Standards, Washington, D. C., aimed to show that certain magnetic and electric tests may be used to supplement or even replace certain mechanical tests. Experiment shows that there is a close relation between the magnetic properties and the presence of flaws, blowholes and strains. The

Fig. 1—View Looking Down on Top of 100-Lb. Rail from Which a ⅛-In. Layer Has Been Broken

mechanical properties, such as elastic limit, tensile strength and hardness, are, within certain limitations, functions of the magnetic reluctance and the electric resistance.

The second paper was written by R. P. Devries, assistant engineer, Bureau of Standards, Washington. Various steels were tested for tensile strength and Brinell hardness. The Brinell figure was studied by measuring the depth of impression for increasing loads at the same spot, giving a direct linear law. The tensile strength was found to be a linear function of the Brinell hardness figure. Magnetic tests showed more variations, but gave indication that in a series of steels, of different composition and heat treatment, there is some relation between magnetic and mechanical properties.

A paper along somewhat similar lines was the contribution of the laboratory of Schneider & Co., Creusot Steel Works, Paris, France, presented by Edward Saladin, chief engineer. The paper covered permeability tests of a series of carbon steels at varying temperatures (850 deg. C. max.) made with a special autographic apparatus, using short-bar, long-bar, and ring specimens. The three forms gave very different magnetization curves; in the long bars the change of magnetism extends over a large range of temperature, while in the short bars the changes are abrupt. The critical point A_2 was shown to be reversible, and the point A_1 not. Near 200 deg. C. there is a decrease of permeability with rising temperature. Weak fields showed a progressively increasing permeability, due to decrease in hysteresis and coercive force. Afterblown Bessemer steel showed high hysteresis at moderate temperatures.

Repeated Stress Testing

A number of papers which had been presented to the congress and printed were read by title only, as their authors were not present. They included: "Recent Researches at the National Physical Laboratory on the Resistance of Metals to Alternating Stresses," by Dr. T. E. Stanton. The experimental work conducted at Teddington since 1904 included ordinary (continuous-variation) alternating-stress tests, and alternating impact tests. The former, carried out in several different forms with radically different machines, showed that rapidity of alternation has no influence on the results (up to 7000 per min.), and that the maximum range of stress is about the same as the higher yield-point value. Alternating-impact tests, begun in 1907, showed that the strength for long-time endurance was apt to be in the reverse order of the single-blow impact strengths. It appeared also that the repeated-impact strength could be computed from the simple fatigue strength.

"Endurance Tests of Metals," by Dr. O. Boudouard, Corbeil, France, was another one of these. The author presents a new method of testing, by measuring the damping of vibrations. A puddled iron and a series of carbon steels were studied. Though the variations of the damping are in general too slight to show change in the material as the test proceeds, yet it is found that the vibration leads to rupture if sufficiently prolonged.

Surface Fissures in Steel Rails

Thursday afternoon's consideration of papers in section on metals was divided in two sessions, one to consider rails and the other cast iron and special steels. John McLeod, assistant to the president of the Carnegie Steel Company, presided. The first paper read was that of J. P. Snow, Boston, Mass., entitled "Some Features of the American Steel Rail Situation." This paper was printed in last week's issue. This was followed by a paper by Professor Mesnager, describing a method of foreseeing rail fractures. Surface fissures on the head of a rail are found to have great influence in causing fractures. They may be nearly transverse or polygonal. Such fissures can be detected on the top face of a rail in the track by filing off about 0.004 in. and etching with weak hydrochloric or sulphuric acid several minutes. They are still better seen if the surface is then treated 3 to 4 min. with tannin containing 3 per cent. gallic acid, and rubbed clean; or (Sabouret) printers' ink rubbed on the etched surface, wiped off, and a sheet of white paper pressed on, producing a print of the cracks. It is held that the sliding friction of the wheels with the application of the brakes heats the thin surface layer of the rail head and this is quickly absorbed by the contiguous mass of the rail resulting in a substantial quenching of the rail head surface. Mr. Wickhorst in presenting his paper, later in the session, remarked that the nature of failures reported by Professor Mesnager are not common in this country. The transverse movement of the metal of the top of the head with metal of lower ductility located below it is a condition likely to develop cracks.

Drop Testing for Steel Rails

J. E. Howard, engineer-physicist Bureau of Standards, Washington, read a paper enumerating the stresses of service, track conditions and metallurgical features which should be kept in mind in making tests to see that those physical properties are secured which are made use of and which, analysis shows, must be provided for. Dr. P. H. Dudley read a paper on testing rails for elongation and ductility of the metal under the "Manufacturers Standard Drop Testing Machine." He held that by suitable measurements of elongation at the bend in a drop-tested rail, an indication of the excellence of the metal is obtained. The results are available within a few hours after the ingots of a melt are teemed, and subsequent melts on the same day can be improved accordingly. The close check on the furnace and mill working thus obtained has enabled greatly increased uniformity and better quality of rails to be realized. The method has been adopted as standard practice by the New York Central & Hudson River Railroad Company. It has been proved to allow adjusting the chemical composition to the mill practice of any particular plant and to the service required.

Max H. Wickhorst, engineer of tests, Rail Committee, American Railway Engineering Association, Chicago, presented a paper describing the American research work concerning steel rails being conducted jointly by the railroads and steel manufacturers and Capt. Robert W. Hunt presented a paper entitled "Insuring Soundness in Steel Rails," printed in last week's issue.

Discussion on Steel Rail Soundness

Professor Belelubsky, in the steel rail discussion, mentioned the study which has been given for some time to rails in service in Russia. The results of the investigation are now available in a volume printed in the Russian tongue which may be had on application to the director of the Institute of Engineers of Ways of Communication,

Fig. 2—Internal Transverse Crack of a Bessemer Rail

St. Petersburg. It is the intention to give the results of the further investigation of the subject to the St. Petersburg congress in 1915.

Henry D. Hibbard, consulting engineer, Plainfield, N. J., discussed the subject with particular reference to the paper by Captain Hunt, and his remarks in part are as follows: "The cure of the blowhole (in the ingot) is to have in the metal just before the final additions a reasonable minimum of dissolved gases and of oxide of iron, and then to add at the end enough solvent (silicon or its equivalent) to keep in solution the gases still in the steel until it is frozen. That is, it must be well-made or melted. The cure of the pipe is compression of the ingot during solidification to keep pace with the relatively greater loss of volume of the interior as compared to the exterior parts of the ingot.

"The cure of segregation may be effected in part by increasing the rate of compression just before final solidification, so that some of the still-fluid metal will be expelled at the top from the body of the ingot. The ingot should be cast in a collapsible mold, large end up. The press should be horizontal acting and after the ingot-mold is placed therein, it should compress the ingot continuously though slowly until freezing is complete. A number of plans proposed for preventing or obliterating pipe provide for a single act, either compression in a press or rolls, or the introduction of a piece of metal to fill the pipe, but a little reflection will show that there is no one instant at which such single act can be effective to the desired end. The cure must be continuous. The mold containing the ingot should be placed in a slow-acting horizontal press in about 15 min. after teeming and the upper third should be slowly pressed by lateral compression until the whole is solid. Just before solidification of the last of the metal the press should be speeded up, so that some of the segregated impurities will be forced out at the top. The rate of travel of the presses should be such as will keep the level of the molten metal always at the top of the ingot.

"The proposal in the paper (of Captain Hunt) of using the top bloom of each rail ingot in splice bars is open to objection, as these bars are an important part of the track-construction, and the use of avowedly inferior metal in them would be hard to defend should an accident result from the failure of one of them. The top rail made from sound ingot should be practically as good as the others.

"In a rail mill the ingot compression would naturally be done as an addition to the stripping operation, and in the same building made larger, of course, to hold the presses. The cost of pressing with a good plant should be much less than that of discarding say an additional 30 per cent. of the ingot or even half of that."

Two other papers scheduled for the session were not considered owing to the lack of time and the absence of the authors, namely: those by O. Gallander on the determination of cracks in conducting metals by measuring the difference of potential of an electric current between two adjacent points, and by Dr. J. E. Stead, Middlesbrough, England, on the welding of blowholes and cavities in steel ingots, a contribution substantially the same as printed in *The Iron Age*, May 30, 1912.

Types of Defective Rails

The Thursday afternoon session was closed with illustrated addresses by Prince André Gagarin, former director

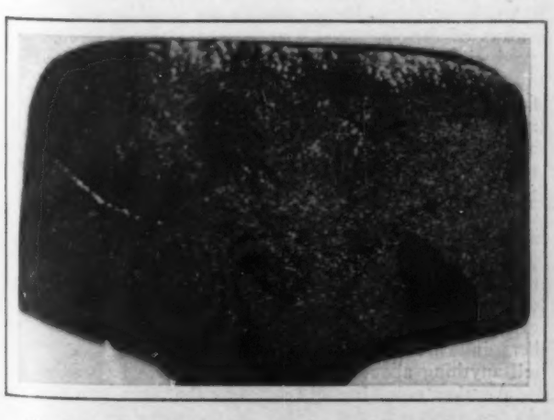


Fig. 3—A Characteristic Form of Internal Transverse Crack

Fig. 4—Three-Fold Enlargement of Spot in Fig. 3

of the Imperial Polytechnic Institute, St. Petersburg, who described a remarkable autographic stress-strain recording apparatus he had devised for use in impact tests, and by Robert Job, the Milton Hersey Company, Montreal, who delivered an illustrated address on types of rail failures and methods for their detection. This address in part is as follows:

"The open hearth process which permits the use of greater toughness and hardness through low phosphorus and sulphur content has been widely extended and the various principles and details of manufacture have been so thoroughly studied that our mills are capable not merely of large tonnage but of high excellence in quality. It is a well-known fact, however, that decided variations in the product at times occur. Sometimes the large majority of the rails from a given rolling give generally good service while only a small percentage are found to contain defects which cause failure in track.

"One of the best known popularly of the defective types is the so-called piped rail caused by defective mill practice in failing to crop the blooms to sound steel. A rail of this kind does not generally fracture in track but mashes down gradually and is detected by the track men and removed before it becomes unsafe. Another type is the split head exhibiting a flowing over on both sides of the head.

"In Fig. 1 we look down upon the top of a 100-lb. rail from which a layer about 3/8 in. thick has broken out in service. A seam runs lengthwise through the rail, and by carefully observing the fracture it will be noted that the failure began at the seam line and extended gradually in service until the crack reached one side of the head and extended nearly to the other. A failure of this kind is particularly dangerous since it is gradually developing while the rail is in service and no outward indication may be given of the presence of the defect. The rail in question was made by the open hearth process and had the following composition: Manganese 0.82 per cent., sulphur 0.030 per cent., phosphorus 0.025 per cent., carbon 0.77 per cent. The composition was normal and gave no indication as to the cause of failure. The etched section from the same rail taken at the same location showed that the steel was thoroughly unsound and porous.

"Fig. 2 shows the type of failure known as an 'internal transverse crack.' This is also particularly dangerous, as it is not present in the rail when rolled but begins to develop in service at some point of weakness within the steel, and gradually extends across the head until fracture of the rail occurs. The rail in this case was made by the Bessemer process and had the following composition: Carbon 0.67 per cent., phosphorus 0.058 per cent., manganese 0.88 per cent., sulphur 0.041 per cent.

"Owing to the dangerous character of this type of failure and the need of definite knowledge as to the prime cause of the growth, we made a critical study of the subject, gathering data throughout the country. I shall not detain you with details, and it will suffice to say that the defect was found in low carbon steel and in high carbon steel, in rails as heavy as 100 lb. per yard and as light as 80 lb., while in some cases where rails as light as 67 lb. were used and subjected to the same wheel pres-

sures none of the defects had developed. The defect was found in relatively small numbers, in both Bessemer and in open hearth steel, made at different mills scattered over the country and in service in various parts of this continent. Thorough study proved beyond question that the composition of the steel in its ordinary elements was not the cause of the failure, and also that the conditions of service were not the prime cause. Analysis of the small central core in these 'spots' was not conclusive, and microscopic investigation proved that the 'spots' were mere cracks and did not extend longitudinally along the rail. In other words, they had no depth, but on examination of the steel in the immediate vicinity of the central core we always found decided porosity or other source of weakness.

"Another characteristic form of internal transverse crack is seen in Fig. 3, a badly segregated open hearth rail in which the manganese content was 1.62 per cent., although the heat average approximated 0.80 per cent. Fig. 4 shows a three-fold enlargement of the spot just shown, and by noting the formation of the ridges it will be apparent that the fracture began inside the head and gradually extended until it reached the surface. The spot was about ¾ in. long. A similar crack was noted in a 110-lb. open-hearth rail in which the manganese was also excessive, 2.62 per cent. being present, whereas the heat average was approximately 0.90 per cent. In both of the latter cases the abnormal composition was caused by failure in manufacture properly to mix the manganese added in the ladle.

Testing Each Rail Ingot

"Our experience has been that defective condition is very seldom characteristic of an entire rolling, but that it is generally present only in individual ingots. Consequently it is clear that in order to guard most effectively against the various defects and at the same time utilize the largest possible proportion of the rolling, it is desirable to test each ingot in the rolling, stamping each rail with its ingot number, in addition to the heat number and the letter indicating its position in the ingot. Also, in order to forestall as far as possible the various defects in the rails, we have found it advantageous to place a considerable number of inspectors throughout the mills in order to watch the progress of the manufacture in its various details and to report all variations which would tend to lessen the value of the product. The plan has been in operation for about one year with very satisfactory results.

"Of the routine tests we have found it advisable to make a drop test upon a butt from each ingot in the heat in order to avoid brittleness, rejecting all rails from each ingot which fail under the test. The ductility test of Dr. P. H. Dudley has also been found extremely useful in helping to avoid qualities which result in some of the types of failures shown above. The test to destruction under the drop to detect piping is also of great value and serves as a check upon the work of the men at the shears and tends to reduce to a minimum the number of piped rails in any given shipment, particularly when the tests are made upon the ingot plan mentioned above. The deflection measurement under the drop test enables one to avoid undue softness, while base seams may be detected if present by making the drop test with the head of the rail downward, as is our regular practice, but with the base slightly inclined so that the drop will strike the extreme side of the base and thus open up as a result of the blow any unwelded seams which may be present. If seams are found the top rail of the ingot might properly be rejected. This modification does not interfere with the effectiveness of the drop test in other respects. . .

"I wish to emphasize with all the force of which I am capable the absolute unfairness of the forcing upon the railroads of this country the detecting of defects which, if the rails were properly made, would seldom be present in the steel. I believe also that I am not amiss in stating that it is to-day the earnest wish of every one who has at heart both the interests of our railroads, for safety and economy of traffic, and also the integrity and development of our manufactures, that the day may not be distant when every artisan in our mills, from the highest to the lowest—through the recompense received in return for his work—shall be made to realize, not that quantity of production is the main goal toward which his energies should be directed, but that quality is the prime requisite. My faith in the efficiency and capacity of our mills is so great as to be convincing that under such a system the mills would become noted in greater measure than ever before, both for the extent of production and equally so for the excellence of the product."

Testing and Grading Cast Iron

At the session devoted to cast iron Thursday afternoon twelve papers were ready for the consideration of the meeting. Of these, a group of four papers, covering much the same ground, were the only ones which were discussed to any extent. An abstract of each of these papers is given below.

Typical Uses of Cast-Iron in American Practice. By Prof. J. J. Porter. The paper reviews the more important classes of iron castings and describes the service requirements. The adaptation of cupola and foundry practice to meet these requirements is briefly stated. The author recommends the development of tests for the various qualities demanded in castings.

Application of the Methods of Testing Adopted for Other Metals to Cast-Iron. By A. Damour, Forges de Bayard, Paris, France. Tests must be carried out under uniform conditions, as the results are found to vary greatly (with diameter of testpiece, casting temperature, stripping temperature, position of testpiece when casting, nature of surface of testpiece, etc., as shown in the paper by curves). Uniform test conditions should be established by the congress, with a view to arriving at a definition of an "international standard testpiece."

Investigation of the Influence of the Shape of Test-bar on the Mechanical Properties of Cast-Iron. By Dr. J. E. Stead, for British Members of Committee, 1b. Experiments comparing the English, German and American standard cast-iron test-bars indicate that the form of testpiece has little influence on the test results if the bars be sound, but that it is somewhat more difficult to obtain sound bars with the English form than with the German or American. The only recommendation made is that a standard bending-test specimen should not be less than 24 in. long, to permit of reasonably accurate measurement.

The Estimation of Pig Iron. By J. Kail. Since the appearance of the fracture of pig does not even allow of reliable conclusions as to the silicon content, and since other elements of influence on the qualities of the iron are determinable only by chemical analysis, the practice of grading by fracture is unreliable and therefore not permissible. Chemical analysis should be the means of grading. A classification into grades by silicon content is suggested in five grades (or three grades).

The principal discussion to this group of papers was contributed by Walter Wood, R. D. Wood & Co., Philadelphia. He stated that formerly all pig iron was graded by fracture, which is a practice which should be generally discredited and chemical analysis substituted for it. Mr. Wood traced the development of the method of grading by fracture. Formerly the only iron used was in the form of castings and puddled iron, and for these purposes the method of grading by fracture was sufficiently accurate. However, as steel-making developed, the requirements of the Bessemer and open-hearth processes required closer control over the composition of the raw material, pig iron, than it was possible to obtain by grading the iron by means of the fracture. Consequently, the steel companies gradually established laboratories and analyzed their raw material and finally adopted the practice of issuing specifications containing the chemical analysis to which the pig iron for the steel mill must conform. Consequently, there are today two methods of grading pig iron. The steel mills depend entirely on chemical analysis, while the foundries to a great extent still grade iron by fracture. Grading the iron by number, as it is sometimes done, is also unsatisfactory, because in this case the content of a single element in the iron must govern the grade, and this method does not tell anything about the remaining elements. For instance, the element usually considered in grading by number, is silicon. The different grade numbers indicate varying percentages of silicon, but do not tell anything about the carbon, phosphorus or sulphur.

Another point brought out was that cast iron test bars do not represent the quality of the metal in the casting,

but only the quality of the molten iron which enters the mold. After the iron is poured there is an opportunity for segregation to take place, which the test bar does not and cannot indicate. In regard to the form of the test bar the round bar has generally given the greatest satisfaction. Various experiments have been made to determine the best length of test bar, but the practice in England, Germany and the United States is still divergent. It was suggested that the congress should make an attempt to have adopted a standard international form of test bar for cast iron.

The remaining papers presented at this session, which occasioned little or no discussion, included the following:

Effect of Superheated Steam on Cast Iron

The Constitution of Cast-Iron and the Effects of Superheated Steam. By Prof. William Campbell and John Glassford. Two castings from a superheater (2 years service) which were destroyed or seriously injured by the steam were examined micrographically. Oxidation of the graphite was found in the damaged portions; other alterations are noted in detail. A series of 23 specimens of pig, cast-iron and steel was subjected to prolonged exposure to superheated steam or many repetitions of heating and cooling, for a study of the effects. Micrographic study showed that white cast-iron, malleable castings and steel oxidized superficially; but in gray cast-iron the oxidation penetrates deeper, following the graphite flakes. The change increases with the silicon content; pig containing 5½ per cent. silicon was thoroughly altered by superheated steam, with the appearance of a new constituent surrounding the oxide areas.

A New Method of Mechanical Testing for Cast-Iron. By Charles. Fremont, Paris, France. A shearing test devised to solve this difficulty uses a testpiece 5 mm. square worked from a 7½-mm. cylinder taken out of the casting with a core-drill. Shearing this testpiece every 3 mm. along its length gives data on strength at different depths below the surface.

A Suggested System of Test-bars for Chillable Irons. By T. D. West, West Steel Casting Company, Cleveland. In testing chillable irons, both the white and the gray phase should be tested. A chill mold for the former and a sand mold for the latter are proposed, both designed with such details as to give a bending-test bar 2¼ in. in diameter by 18 in. long, for 12-in. span, with shoulders cast in the bar to enable the contraction to be measured directly on the bar as cast. Drawings of the molds and bars are shown elsewhere in this issue.

Commercial Tendencies in Malleable Castings Practice. By Dr. Richard Moldenke, Watchung, N. J. The author calls attention to the strong tendency exhibited in recent years unduly to push the quality of a cheap material to its upper limit, rather than to step at once to the higher grade material. Particularly in the case of malleable iron is this extremely undesirable, as the qualities that make this material so useful for resistance to shock are sacrificed thereby. Objection is raised to the so-called "transition materials" as these are undesirable, unreliable and really "selling tricks" on the part of the manufacturer, as well as evidences of lack of knowledge or detailed information on the part of the consumer.

Effect of Cold Working

The first subject considered by the metals section at the Friday morning session was the effect of cold working on the physical properties of metals. The subject was presented by W. R. Webster, Philadelphia, who described tests of eight metals. They were tested for tensile strength, elongation, contraction and in some cases yield-point, for various degrees of reduction by rolling, up to 70 per cent. reduction (*i. e.* rolling to 30 per cent. of initial thickness). The original bar was annealed. The metals were: Monel metal, aluminum bronze, silver, cartridge metal, copper-nickel alloy, copper rod, brass rod and bar copper. All eight metals showed a regular rise of tensile strength and a decrease of ductility.

Metallography in Copper and Brass Working

The industrial utilization of metallography as a check in the working of copper and brass was the subject of a paper by Capt. C. Grard, Ministry of War, Versailles, France. The effects of cold-working and of annealing were studied micrographically and by tensile tests for a 67-33 brass and a 90-10 brass, showing for all degrees of cold-working an abrupt fall of strength and elastic limit and a rise in elonogation between 250 deg. and 350 deg. C., with slower change thereafter. Somewhat similar curves were obtained for copper. Throughout, the micrographic structure was found to indicate the prior treatment quite clearly.

Bearing Metals

N. Pecoraro gave the results of researches on white metals in a paper in which it was stated that: (1) the temperature of bearing metals seems to have a distinct influence on the resistance to wear; (2) the Brinell hardness number may give indications as to wear; and (3) the only mechanical tests of bearing metals having practical value are the hardness test, impact tests which may give indications as to brittleness, and such tests in gradual compression as measure the value of the metal for supporting its working loads.

G. H. Clamer, Ajax Metal Company, Philadelphia, described the work of the bearing metal committee of the American Society of Mechanical Engineers, which is conducting a research into the subject of bearing metals. It has found that the five alloys listed in the table are in general use in the United States and may be regarded as standard alloys for bearing metals:

Tin	Copper	Antimony	Lead
89	4	7	..
83⅓	8⅓	8⅓	..
50	2	12	36
7	..	17	76
..	..	10	90

The committee has under investigation the following subjects: Hardness at ordinary temperatures; hardness at elevated temperatures; compression at ordinary temperatures; compression at elevated temperatures. It is also investigating methods of sampling and of testing, and also questions of heat treatment. The committee proposes to formulate a specification for these five alloys—not because they are necessarily the best, but because they are giving general satisfaction, and it is considered wise to prepare specifications now rather than wait for the conclusion of an investigation of a long series of alloys which would require years and which would not perhaps reveal any alloy much better. The specification will cover the following points: Composition, including limits of segregation and impurities; methods of sampling; heat treatment and physical tests.

Dr. Fritz Cremer, metallurgist and chemist, Marshall-Wells Hardware Company, Duluth, Minn., said that he had found the surface condition of the bearing to be the most important consideration. A metal of 80 per cent. hard material and 20 per cent. of soft plastic material gave the best satisfaction as it permitted the most satisfactory lubrication. The hard particles projected from the soft metal and bore against the shaft as the bearing wore, thereby allowing the oil to flow freely throughout the bearing through the channels thus formed.

The wear of bronzes was the subject of a paper by A. Portevin, Paris, and E. Nusbaumer, Usines Derihon, Brussels, for the preparation of which the Derihon abrasion-test machine described at the fifth congress was used. The testpiece is pressed against a polished steel disk running in an oil bath. The following conclusions are drawn: (1) The wear of ordinary bronzes is proportional to the tin content, or rather to the *delta* content. (2) The presence of phosphorus yields a bronze wearing less than non-phosphoric bronzes high in tin but more than non-phosphoric bronzes low in tin. (3) A hardened skin may form during the test, upon whose disappearance there is sudden rapid wear. (4) A tendency to crystallization on annealing corresponds to this hardening.

Specifications for Copper

A report of Committee 38 on specifications for copper was prepared by L. Guillet which embodied specification clauses for copper (mechanical and electrical material) in the form of nine resolutions. The report as presented did not meet the views of a number of members of the committee, particularly the American and British members, who had had no opportunity to communicate with the chairman. The meeting therefore declined to receive the report and it was referred back to the committee for completion and agreement among the members.

Effect of Temperature on Alloys

The effect of high temperature on the physical properties of some alloys was the subject of a paper by I. M. Bregowsky, metallurgist, Crane Company, Chicago, and L. W. Spring. The alloys tested include copper-tin bronze, 12.5 per cent. tin and 10 per cent. tin; brass; aluminum bronze, 5 per cent. aluminum and 10 per cent. aluminum; cast manganese bronze; United States Navy brass "S-c" for screw pipe fitting; United States Navy bronze "M"; United States Navy gun bronze "G"; cast "Monel metal"; soft cast iron; cast iron (so-called semi-steel); cupola malleable iron; cast steel; cold-rolled shafting (Bessemer); rolled rod brass; rolled 30 per cent. nickel steel; rolled Monel metal; cold-rolled shafting Cumberland cold-rolled shafting; open-hearth machinery steel; 3.5 per cent. nickel-vanadium steel; 25 per cent. nickel steel; 30 per cent. nickel steel; 0.35 per cent. carbon; Cumberland cold-rolled shafting; vanadium tool steel; rolled Monel metal, in two thicknesses; rod brass; Tobin bronze; elephant phosphor bronze; delta metal, and Parson's manganese bronze.

Harold Perrine and Chas. B. Spencer described a method of testing steel castings at varying temperatures in a Riehle testing machine. The testpiece was surrounded by an electric heater which could raise the temperature of the piece to any desired point, at which it could be maintained by regulation of the current supplied to the heater. The work was done at the laboratory of the Crane Company at Chicago.

Tests of Wire and Welds by Impact

Three papers were presented by Chas. Fremont, which respectively described new means of testing rivet steel, steel wire and welded metal. The testing method for steel wire, required that the wire be held in sleeves extending close to the center, where the hammer of the impact-test machine strikes. The wire is notched here with a file; wire not notched may not break, even though unsound, while the notched wire breaks if defective but bends and stretches if of good quality. To test welds the Fremont impact test was applied, but without notching the specimens. All testpieces showed a strength less than that of the metal. Results are reliable only when the testpiece is directly transverse to the weld. As a general conclusion, welds even when perfect (which cannot be known until the piece is broken) are always weaker than the metal.

Strength of Welds

Max Bermann claimed that Mr. Fremont's paper does not solve the problem of evaluating the strength of welds without damaging the material but does present a method of comparing welds by means of numerical figures.

Dr. Denny objected to a statement in the paper on welds, that welds should never be allowed where the accidental fracture of the piece would be attended with danger. He pointed out that there were many situations in which welds could not be avoided; for instance, in chains. While no one desired to use welds if it could be helped, a sweeping statement like that of Mr. Fremont should not be allowed. Furthermore, the percentage of failure of welds in service was not unduly high, Dr. Denny maintained, as compared with other methods of construction.

R. H. Danforth, engineer, United States Naval Academy, Annapolis, agreed with Dr. Denny, and pointed out that the acceptance of Mr. Fremont's statement would eliminate entirely lap-welded pipe, which is universally used for steam. We cannot yet afford to dispense with welding in this particular article.

Dr. Rosenhain recalled the results of weld tests made at the National Physical Laboratory, England, which indicated that welds were absolutely unsafe. He explained that the steel was overheated and received comparatively little working thereafter. He was exceptionally severe on autogenous welding processes, which raised the steel to extremely high temperatures and gave it absolutely no working. The use of this process in steel structures subjected to severe stress could only be attended with danger. A series of questions brought out that the remarks in the discussion applied only to so-called welds in steel, and that welds in wrought iron were safer.

Welding Processes

Two papers, one entitled "Theory of Welding and Its Practical Application," the other "The Nature of Autogenous Welding of Iron and Steel, and Applications," both by Max Bermann closed the morning session. The author stated that welding requires purely metallic contact of the iron particles, pressure sufficient to secure cohesion between these particles, and the welding temperature. Pure metallic contact is secured by the reduction of the iron oxide, the elements for reduction being contained in the metal itself (manganese, phosphorus, silicon, etc.). The required pressure is small, in view of the plastic state of the iron at the welding temperature. The welding temperature is that at which the rapidity of the reducing reaction is the greatest.

In autogenous welding two pieces are united while their contact surfaces and the binding metal are in fluid state. The welding flame should be slightly oxidizing. Iron oxide is reduced by the manganese, phosphorus and silicon contents of the steel, assuring metallic contact of the iron particles. The binding metal must be identical with the metal of the pieces to be welded; it may be selected by the spark test.

Friday afternoon's session of the metal section opened with a paper by J. A. Capp, engineer testing laboratory, General Electric Company, Schenectady, N. Y., and Prof. T. R. Lawson, Rensselaer Polytechnic Institute, Troy, N. Y., entitled "Thermoelectric Indication of Strain as a Testing Method." The thermal phenomena occurring in a tensile testpiece were studied on about 40 speciments of different metals. The temperature indication was obtained by means of a sensitive thermoelectric cell consisting of 20 couples, fastened to the side of the testpiece, and a galvanometer. The experiments are inconclusive as yet.

A New Finding in Metallography

A paper was then read by Prof. Albert Sauveur, of Harvard University, entitled "Crystalline Growth of Ferrite Below Its Thermal Critical Range." Bars of steel containing 0.05 per cent. carbon were strained through the application of various stresses, such as tension, compression (ball test), bending, shearing, twisting, etc. The strained samples were annealed for seven hours at 650 deg. C. From the results obtained, it is concluded that strained ferrite will not grow on annealing unless it has been subjected to a certain critical stress creating a critical strain. Samples or portions of samples strained more severely or less severely than the critical are free from crystalline growth.

This paper was well received. Dr. Rosenhain regarded it as strange that a crystalline growth developed as described only when the strain occurred between limits so restricted. He observed that if polished testpieces, on account of deformation, exhibited slip bands there would, on repolishing, be no trace of the slip bands if the strain had not been great enough. He expressed the hope that the conclusions will be further substantiated. Dr. Howe complimented the author on the elegance of the establishment of the unexpected result and expressed an interest to ascertain the degree of parallelism of the phenomena observed to the effects of wire drawing. Professor Rejtö also discussed the paper.

Action on Iron and Steel Nomenclature

Dr. Howe for Committee 24 then reported on "Nomenclature of Iron and Steel Products," which report was reprinted in *The Iron Age* of last week. Dr. Allerton S. Cushman, director Institute of Industrial Research, Washington, D. C., objected strenuously to the definition of steel, claiming that it was tantamount to saying that it is impossible to make iron in the open-hearth furnace. He decried the custom to describe the product or limit the definition of a product by the method of its manufacture, regarding it as parallel as claiming that tea brewed in a coffee pot must be coffee. He could not conceive that a metal, "whether it can be hardened or not, whether it contains much or little or even no carbon, and for that matter even if it is chemically pure iron," can be called steel, as the committee reported. He regarded the committee in such an attitude as seeking to upset usage.

Henry D. Hibbard considered that the usage of 40 years justified the opinion of the committee and that iron

of fluid origin which is cast into a mass which is usefully malleable initially should be known as steel without regard to the amount of carbon. Dr. Cushman replied that while he recognized that iron fitting this definition has for more than 30 years been called steel, the fact that the nomenclature has been wrong for forty years was no reason why it should be continued. He regarded ingot iron as the nearest product to pure iron ever obtained in large quantities; for example, 80 tons at a time.

Professor Belelubsky explained that in Russia a term corresponding to soft steel is not used, but a term corresponding to ingot iron is used for describing a product such as Dr. Cushman had in mind. He mentioned that the Germans use the term flüsseisen, and the French the term acier extra doux, and claimed that at the Philadelphia Exposition the Americans introduced the term ingot iron.

Dr. Howe claimed that Dr. Cushmaan was misinformed regarding usage, as steel in both England and France had been known for 40 years to mean a product poured in the molten state in ingots; that it was made low in carbon when desired, as low as 0.04 per cent.; that its essential qualities came from being cast and freed from slag thereby; that we have no adjective properly to describe it; that it did not include blister steel and products having a high percentage of carbon and hardening power; that the use of the name steel persisted as the demands of trade failed to listen to appeals to reason in first applying the name steel.

Professor Martens, of the Royal Material Testing Bureau, Charlottenburg, Berlin, explained that Germany now is in possession of well-established definitions and nomenclature and it would resist for the present at least any change. Prof. E. Heyn, subdirector of the bureau, expressed the view that in America there did not seem to be any unanimity and he asked how English-speaking nations would like to have projected a system of definitions reversing iron and steel.

Dr. Howe, who had at the outset offered a motion to submit the report for consideration finally at the closing session of the congress, had in the meantime expressed the great discouragement which eleventh-hour opposition means to the labors of a commission. He had been engaged for 6 years on this work and had received no objections from some of the nations now heard from adversely. He withdrew his motion, which nullified an amendment offered by Dr. Cushman and seconded by R. B. Carnahan, Jr., general superintendent American Rolling Mill Company, Middletown, Ohio, to lay the report on the table. Dr. Howe's withdrawal of his motion drew forth applause partly from those who were anxious to see an amicable settlement for the time being, but largely from those who recognized the self-abnegation of the chief author in relation to a work he was anxious to complete, and Dr. Howe was given a vigorous vote of thanks. At Dr. Howe's request the motion prevailed requesting the council to discharge the committee, the opinion being, however, that the committee should be expanded by the council and the work continued.

Resolutions on Committee Reports

Consideration was then given to resolutions to be offered by the metals section to the regularly appointed committee for Saturday's general session. One of these, which was carried, related to transforming committees 1a and 1b from bodies to draw up international iron and steel specifications to bodies whose work will be compilation and dissemination of existing specifications in different nations. This resolution was printed in substance in last week's issue. It was voted also that the congress should express appreciation of the work of Committee 26 on impact tests and should request that a number of different questions be studied and reported on at the next congress, such as the weight of the drop, the weight of the anvil, the form of the supports, the hight of drop and the dimensions of the notches of the bars tested. It was voted to accept the report of Committee 53 giving standard definitions covering the microscopic constituents of iron and steel. This is reprinted in this issue.

Papers on Metallography

On account of the lack of time the remaining papers of the program for the Friday morning session on metals were simply read from title. The papers were in part as follows:

Progress of Metallography from the Beginning of 1909 to the End of 1911. By Prof. E. Heyn.

Standard Magnifications for Micrographs. By M. T. Lothrop and C. R. Bulley.

Utility of a Uniform Nomenclature in Metallography. By F. Robin. Several methods are suggested for building up a systematic nomenclature, in place of the present series of proper names, which lack logical meaning.

Micrographic Observations. By P. L. M. Ry. Testing Laboratory. When a plate is cut with the oxyacetylene blowpipe, a carburized zone is found at the edges of the cut. A hardened layer is produced by screw-cutting; the ferrite shows as though crushed and of needle structure. Recognition of steel in piled iron: pearlitic zones are clearly discernible; they are less sharply marked with puddled steel than with melt steel.

The Life History of Pro-Eutectoid Cementite. By H. M. Howe and A. G. Levy. By studying the structure of two hypereutectoid carbon steels after heating to various temperatures and cooling rapidly, with subsequent tempering, etc., the formation of cementite was followed.

Proposal to Include the Spark Test in the Association's List of Problems. By M. Bermann. As it is now possible to determine, by comparison of grinding-spark pictures with a set of standards, the carbon, silicon and manganese content of iron and steel, with considerable accuracy, the congress is asked to include the spark test in the association's list of technical problems.

The Closing Session

The general or closing session of the congress on Saturday morning, September 7, was called to order with Dr. Howe in the chair. On his recommendation a word of greeting was ordered transmitted to the illustrious patron of the congress, William H. Taft, President of the United States.

Among the numerous resolutions which were then separately voted were the following: That the council be authorized to make appeals for further financial support to governments and associations to carry on the association's work; that the by-laws allow for life membership to cost £15 or its equivalent and to exempt the holder from annual dues; that the by-laws allow for more than two vice-presidents.

The report of the auditors regarding the financial status of the association was accepted. The resolutions of the metals section, including that offered in the interest of Committees 1a and 1b on iron and steel specifications; that for Committee 26; that for Committee 38 to include copper alloys in the study of the principles of specifications for copper, and that for Committee 53, recommending standard definitions for the microscopic constituents of iron and steel, were all adopted.

The closing moments of the congress were marked by numerous felicitations. A cordial invitation transmitted through Vice-President Belelubsky to hold the next congress in St. Petersburg was accepted. A number of tributes were paid to Dr. Howe for his grands travaux and he was announced as having been made a life member. In his graceful acknowledgment he averred that "where there is the heart, there is no labor." The representatives of different countries took occasion to express their pleasure with the kindness and hospitality shown by the hosts in connection with the congress and among those who voiced the sentiments were Dr. W. C. Unwin, speaking for the English Government, the Institution of Civil Engineers and his English colleagues. Through Dr. Rudolph Hering, of New York, the Verein Deutscher Ingenieure sent its greetings.

Prof. Belelubsky was then unanimously elected president. On motion of Prof. Edgar Marburg, secretary of the American Society for Testing Materials, the cordial greetings of the congress were ordered transmitted to Mrs. Charles B. Dudley, as an added recognition of the great debt owing by the congress to the late Dr. Dudley and his works reaching fruition at this time. It was announced that Captain Hunt enters the council as the representative of the United States. At the suggestion of Dr. Howe a vote of thanks was given to the numerous organizations, institutions and individuals, mentioning them by name, who had been instrumental in providing for the tours and in making the stay in New York pleasant. In a brief final word Dr. Howe brought the congress to a close.

Two New Molding Machines

Recent Additions to the Osborn Line for Widely Dissimilar Classes of Work

The Osborn Mfg. Company, Cleveland, Ohio, has recently made two important additions to its line of molding machines. One is a direct-draw roll-over jolting machine, designed particularly for small, deep castings used in building automobiles and the other is a power roll-over machine built for large, flat work.

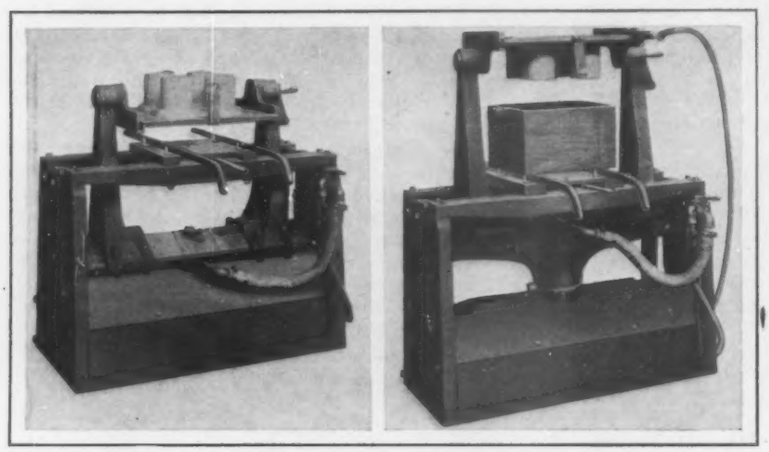


Fig. 1.—The Pattern Mounted and Ready for Ramming

Fig. 2—The Mold Rammed and the Pattern Drawn

Two Views of the New Direct-Draw Roll-Over Jolting Machine Made by the Osborn Mfg. Company, Cleveland, Ohio.

The former machine is equipped with one air cylinder in the base, which is used for jolting the mold and drawing the pattern. An important feature of this machine is that it does not require a table. The cylinder is connected with trunnions that pass through the upper part of the frame and support the flask or core box on a plate. This plate slides into grooves in the trunnions which can be easily moved back and forth by a lead screw and crank and thus be made to fit plates of any desired size. With this form of construction the necessity of rolling over a table of fixed size is avoided, only the actual load being rolled. A view of this machine with the pattern mounted and ready for ramming is given in Fig. 1.

After the mold is jar rammed the bottom board is clamped in position and the mold, which revolves on an axis passing near its center of gravity, is easily rolled over by hand and by having plates adapted to the patterns to be used the mold will always revolve on this axis. The table is equipped with an Osborn four-pin levelling device. After being rolled over the flask rests on two sliding steel arms. These arms and the leveling pins automatically adjust themselves to any unevenness of the bottom board and are locked in one operation by a lever which is shown in front of the machine. The clamps are then removed and the air is turned on, which causes the trunnions to rise and draw the pattern. While the pattern is being drawn the mold is held in alignment with the pattern by a simple locking device. After the pattern is drawn as illustrated in Fig. 2, the flask is easily removed by sliding it clear of the pattern on the steel arms which slide in the pins as shown. With this arrangement the arms can be pulled out to the length of the slots or the width of the flask.

The machine has a maximum pattern draw of 10 in. and the trunnions supporting the flask or core box can be quickly adjusted to flasks from 14 to 32 in. in length and any width up to 24 in. It is also made in two larger sizes for heavy work.

The construction of the machine is simple and durable and the easy roll-over and the direct and accurate draw of the pattern are said to make it a most efficient one for small, deep castings. It is claimed to be equally adapted for the coreroom and the foundry. Before being placed on the market it has been given a long test at the plant of the Ferro Machine & Foundry Company, Cleveland, Ohio. In automobile work it is adapted for making piston rings, cylinders, crank cases, flywheels, brake frames, crank case cores, jacket cores, etc.

The power roll-over machine is designed for handling half molds from 1000 to 6000 lb. with a pattern draw of from 6 to 15 in. It will take flasks up to 6 ft. square. In general practice the housings are sunk into a pit so that the top of a car that runs on a track beneath the machine, on which the mold is deposited, is on a level with the floor.

The mold is first rammed on the machine by hand, after which the flask is rolled over by power by a rack and pinion arrangement, the position of the machine before rolling being shown in Fig. 3. When the air is turned on a gear mechanism in the housings engages with trunnions. After the rolling-over process illustrated in Fig. 4 is completed and a half revolution of a circle is made, the gears go out of mesh and the continuation of the operation of the same mechanism causes an upward movement until the flask is raised sufficiently to allow the car to be run underneath. Then the air is released and this permits the mold to be lowered until it rests on the leveling pins in the car. The car is equipped with a standard Osborn four-pin leveling device to compensate for unevenness of the bottom board. The four pins are locked and released by one operation of a lever in the front of the car. After the clamps are removed the same mechanism in the housings is employed in drawing the pattern. When the pattern has been drawn, as shown in Fig. 5, the car is pushed clear of the machine and the mold is carried away on a crane and the table is revolved to its original position, where it is ready for mounting another pattern.

The main air cylinder is located at one side of the machine below the floor level, as shown in Fig. 6. Two small air cylinders which are placed under the table operate projecting lugs that hold the frame steady so that it cannot get out of alignment during ramming. Air cannot be turned into the large cylinder while the frame is locked because the levers controlling the air for the large cylinder and the locking device interlock with each other.

The construction of the machine is very simple, there being as few moving parts as possible, and a uniform steady roll is assured by the fact that the mold revolves about its center of gravity. The motion is further con-

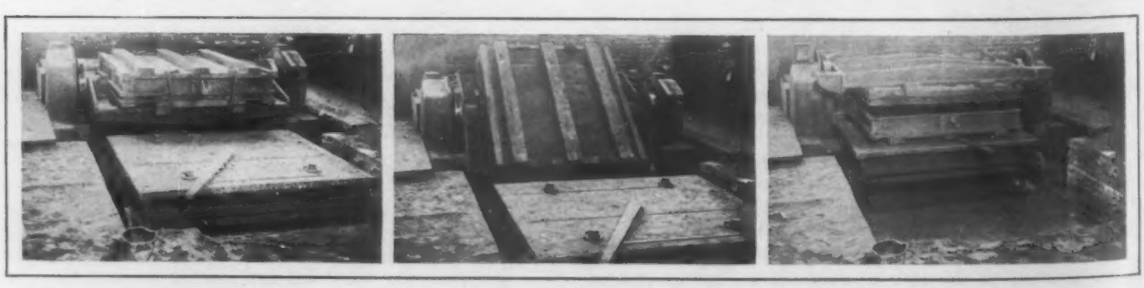


Fig. 3—The Flask Rammed and the Pattern Ready to Be Rolled Over

Fig. 4—The Flask in the Process of Being Rolled Over

Fig. 5—The Flask Rolled Over and the Pattern Drawn

Three Successive Stages in the Operation of the Osborn Direct-Draw Power Roll-Over Molding Machine

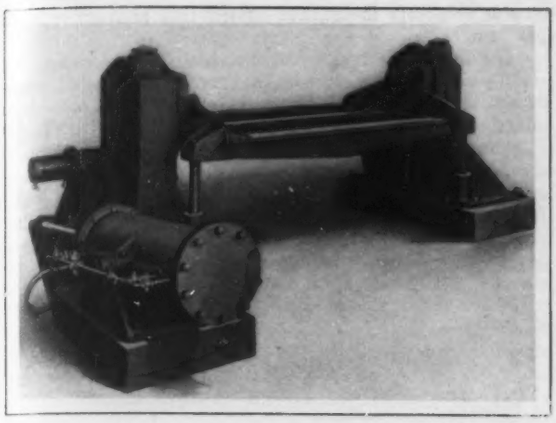


Fig. 6—The Main Air Cylinder

trolled by friction brakes, the trunnions working against shoes on the frame of the machine. Attached to the frame of the machine are cast-iron pockets which support springs upon which the shoes rest. These are kept in tight contact with the brakes which also aid in maintaining the evenness of the roll. The air cylinder is so arranged that the speed of the roll-over is always the same, but any desired rate can be maintained by setting exhaust cocks for the speed wanted. It is claimed that this machine embodies the simplest, quickest and most accurate methods of drawing patterns on large, heavy molds.

A Double Oil Filter

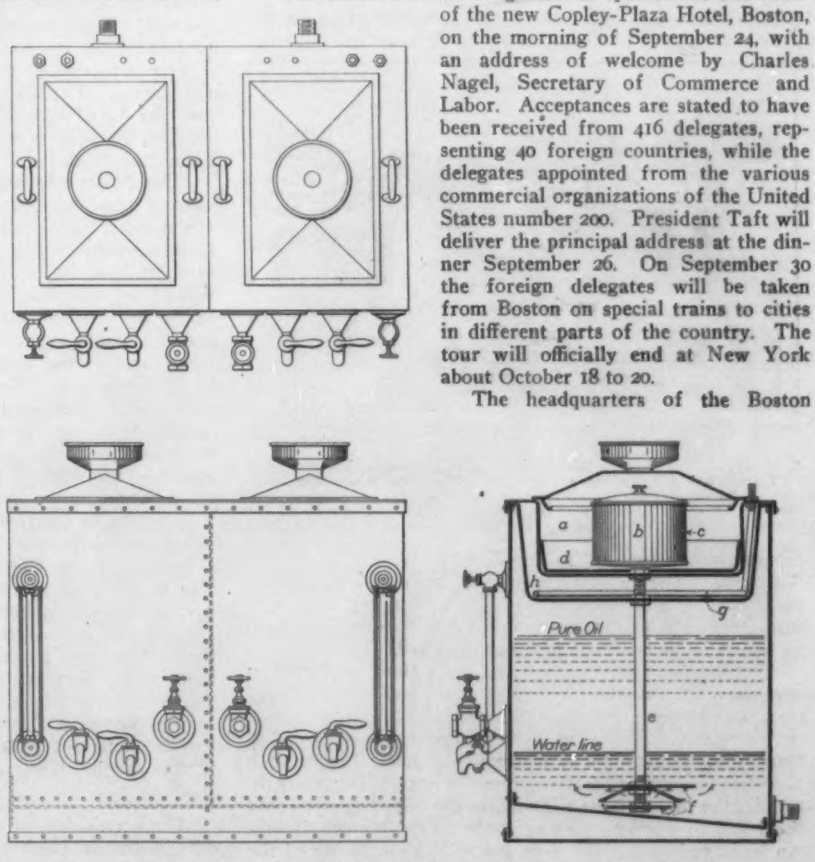
A new oil filter, designed to supply the requirements of users who desire to filter two kinds of oil at the same time, has recently been brought out by the Burt Mfg. Company, Akron, Ohio. This is accomplished by the construction of a double filtering unit. With the exception of being a double unit, the general construction of the filter is similar to the No. 15 unit type of filter built by this company. The operation and construction of this filter is shown in the sectional elevation reproduced in the accompanying drawing. In the Burt unit oil filtering system the oil is fed to the different bearings by gravity from an overhead oil reservoir. After passing through the bearings it is piped to the filter in the basement and after being purified is pumped to the reservoir, making the process automatic and requiring little attention.

In this filter the dirty oil enters the waste oil receptacles *a* at the top, from which it filters horizontally into the filtering cylinders *b* which are 10 in. in diameter and are wrapped with cloth *c*, through which the oil must pass. The heavy impurities fall by gravity into a sediment pan *d* and do not clog the filtering cloth or the filtering material. From the filtering cylinder the oil passes through a quantity of animal boneblack and down tubes *e* into the bottom of the filter. Baffle plates *f* attached to the bottom of the tubes spread the oil out into a thin film and it is thoroughly washed by the water in the bottom of the pure oil cylinders. Should any impurities remain in the oil they will drop to the bottom of the filter and can be flushed out by opening a gate valve which connects with a 1¼-in. drain pipe leading to the sewer. A ¾-in. steam pipe, *g*, runs through the upper part of the filter, the object of this being to heat oil by a hot water chamber, *h*, before filtering and to cause it to flow more freely, thus increasing the capacity of the filter. An overflow pipe is attached to the pure oil reservoir so that the oil can be run into the filter. This prevents an overflow when the pure oil pump is in operation.

The cleaning of the filter is a simple operation and is done by shutting off the flow of oil in the section to be cleaned and removing the cloth around the filtering cylinder. If the filtering material also needs to be replaced the cylinder is unscrewed and the material is changed.

Heavy sheet steel is used in the construction of the filter. The body is riveted to a heavy wrought-iron frame making the filter strong and durable. All seams are lapped, riveted and soldered. Both the lower and upper parts of the filtering cylinders are made of heavy cast iron nickel plated on top. The tubes are of wrought iron.

The filtering capacity of the filter is from 100 to 250 gal. per day of 24 hr. for each unit. The capacity of each pure oil chamber is 45 gal.; of each waste oil chamber, 10 gal., and of each hot water chamber, 20 gal. The filter is 42 in. long, 28 in. wide and 36 in. high.



A New Type of Filter Capable of Handling Two Kinds of Oil Simultaneous, Which Has Been Recently Developed by the Burt Mfg. Company, Cleveland, Ohio

International Chambers of Commerce Congress

The programme of the Fifth International Congress of Chambers of Commerce, including other commercial and industrial associations, which is to be held at Boston, September 24 to 28, is a most interesting polyglot publication. The order of the day for the official sessions is printed in 16 languages, namely, French, English, German, Spanish, Italian, Portuguese, Russian, Swedish, Norwegian-Danish, Dutch, Hungarian, Bohemian, Polish, Turkish, Chinese and Japanese.

The sessions of the congress will open in the ball room of the new Copley-Plaza Hotel, Boston, on the morning of September 24, with an address of welcome by Charles Nagel, Secretary of Commerce and Labor. Acceptances are stated to have been received from 416 delegates, representing 40 foreign countries, while the delegates appointed from the various commercial organizations of the United States number 200. President Taft will deliver the principal address at the dinner September 26. On September 30 the foreign delegates will be taken from Boston on special trains to cities in different parts of the country. The tour will officially end at New York about October 18 to 20.

The headquarters of the Boston Executive Committee are in the Boston Chamber of Commerce. George S. Smith, president in 1911 of the Boston Chamber of Commerce, is chairman, and Robert J. Bottomly is secretary.

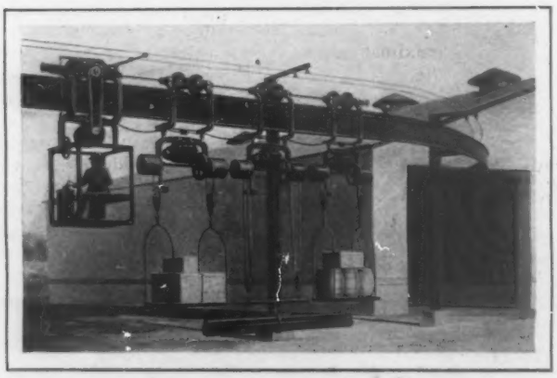
Transporting Freight by a Telpher Train

The Use of Several Separate Trailers a Special Feature of the Westinghouse Design

For handling miscellaneous packages or what is known as less than carload lots in railroad freight terminals and transfer stations, the Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., has developed an interesting type of transportation system. The trains used run on a single elevated rail and consist of a motor-driven tractor with one, two or three trailers. The advantages of this system are the transferring of freight from one point to another without rehandling and an increase in the capacity of the freight house. These machines hoist, convey and load and can be arranged to serve every point in any given space and can tier packages to a much greater hight than is possible by hand. It is also possible to transfer the freight with more speed and economy than can be done by cranes, motor or hand trucks. Each of the trailers has a motor-operated hoist and these together with the motor on the tractor are controlled by an operator stationed in the cab of the tractor.

In operation the articles to be transported are attached to the trailer hoists or are loaded on flatboards or trucks which are attached to the hoists as illustrated in the accompanying engraving. The load is then raised and conveyed to any desired point, a number of extra flatboards or trucks being used so that they can be loaded and unloaded without delaying the telpher.

A Westinghouse telpher train can carry many times the load that can be handled by a hand truck and can move six times as rapidly. Another advantage is that there is little or no interference between the telpher trains, while it is pointed out that frequently considerable time is lost with trucking on account of congestion in the aisles. The train, too, does not have to wait for loading and unloading, as it simply deposits an empty flatboard and picks up a full one, or vice versa. In this system practically all the lifting is done by the hoists, all heavy articles being hoisted



A New Form of Telpherage System Consisting of a Motor-Driven Tractor and One or More Trailers for Handling Miscellaneous Packages Built by the Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

separately and the lighter ones are easily handled on the flatboards. The advantage of this arrangement is that the raising and lowering of the packages by the hoist renders the goods less apt to be injured or broken in transit, as would be the case if they were trucked.

The increase in the capacity of the station is effected in several ways. In the first place the greater rapidity of the telpher tends to reduce the amount of goods stored on the receiving platforms. Where packages are tiered by hand, the tiers cannot be economically made higher than 5 or 6 ft., while with this system it is only necessary to restrict the hight of the tiers where the telpher passes over them and in this way two or three times as much freight can be placed on a given floor space. The economy of the telpher as compared with trucking is the natural result of its ability to handle large quantities of material so much more rapidly. In one test case 15 men with telphers loaded 2000 tons of freight in the time required for 110 men to load the same quantity by hand trucking. In general, the saving in the cost of handling freight by a telpherage system as compared with hand trucking after the interest on the necessary investment is deducted is from 25 to 40 per cent.

The use of a separate tractor with several trailers instead of a combined tractor and carrier is a special feature of the Westinghouse system. In this way it is possible to effect considerable economy in the handling of the freight. For instance, there is less dead weight in proportion to the carrying capacity and less power is required, while if not required one or two trailers can be disconnected which further reduces the weight. The use of separate trailers also increases the speed and ease with which freight can be handled since in handling less than carload lots the various packages constituting a consignment must be kept together. The average weight of a consignment of this character is 750 lb., and a full train can carry three consignments on separate flatboards. Each lot can be loaded on a flatboard weighed, conveyed to the proper car, checked and loaded with a minimum loss of time. When the consignment consists of packages of different classifications, the use of separate flatboards is even a greater advantage since one package after another can be loaded on the flatboard and weighed and the whole consignment kept together. Where the tractor and the carrier are a single unit it is pointed out that it has been found uneconomical to carry more than one consignment per trip by reason of the trouble which arises by mixing consignments and the delay occasioned by the partial unloading of the flatboards. For this reason it is possible for the Westinghouse train to make three trips while the other is making one, and the same amount of work can be done with fewer trains and less men, more speed and less congestion at the switches and loading platforms.

The frame of the tractor truck is a single steel casting, the wheels being double-flanged. The tractor is driven through a silent chain and gears from the motor and a brake can be applied to both wheels by turning a handwheel in the cab. Structural steel is used for the operator's cab, which is so arranged that the operator has an entire and uninterrupted view of the track and the trailers. Two controllers are mounted in the truck, one to control the tractor motor and the other for the hoists. The construction of the trailer trucks is similar to that of the tractor. The suspension beams are pinned at the truck and the hoist yoke is swiveled to the beams so that the load on the hoist is free to swing in any direction without tilting the truck.

The hoists are operated by standard 230-volt, direct-current crane motors. The current for these motors and the traction motor, which is of the same type, is collected from a single trolley with a bonded rail return or from two trolleys on a non-grounded circuit. Each of the hoist motors have a normal capacity of two tons, a maximum full load hoisting speed of 60 ft. per min., and has sufficient cable to hoist 50 ft. Electro-dynamic braking is used for lowering and each motor has a solenoid-operated brake which holds the load automatically when the power is cut off. Overwinding is prevented by a limit switch which opens the circuit and applies the brake when the hoist is raised to a predetermined point. It is, however, possible to lower the hoist from this point by reversing the controller.

The tracks for this system can be arranged in a number of different ways. Where goods are to be transported merely from one point to another, as from a freight station to a warehouse, a single straight track is all that is necessary. If, however, the telpher is to be used for loading cars in a freight terminal, a loop is run around the building and transverse tracks reached from the main loop by switches are run over each platform. For serving every point of a given area, as is the case with a dock or warehouse, the track consists of a loop around the building and a movable transverse track upon which the telpher can be run by sliding switches.

The acquisition of some 25 power, electric railroad and other plants in Illinois by the Central Illinois Public Service Company, it is now stated, will result in the establishment at Kincaid, Ill., of a huge power plant which will be constructed to take advantage of the coal supply in that vicinity, which is central to all the utilities thus secured. The plants involved in the huge scheme are located in 22 towns. A huge reservoir is also to be built to supply water for the boilers of the plant.

The Edison Giant Crushing Roll

Details of an Installation at the National Limestone Company's Plant

BY J. F. SPRINGER, NEW YORK CITY

High efficiency characterizes the methods of crushing and screening developed by the Edison Crushing Roll Company, Stewartsville, N. J. The rolls made by this company were illustrated in their original form in *The Iron Age*, October 28, 1897, but an installation of the improved rolls now used has been made at the plant of the National Limestone Company, near Martinsburg, W. Va., which was erected by W. W. Lindsay & Co., Philadelphia, Pa.

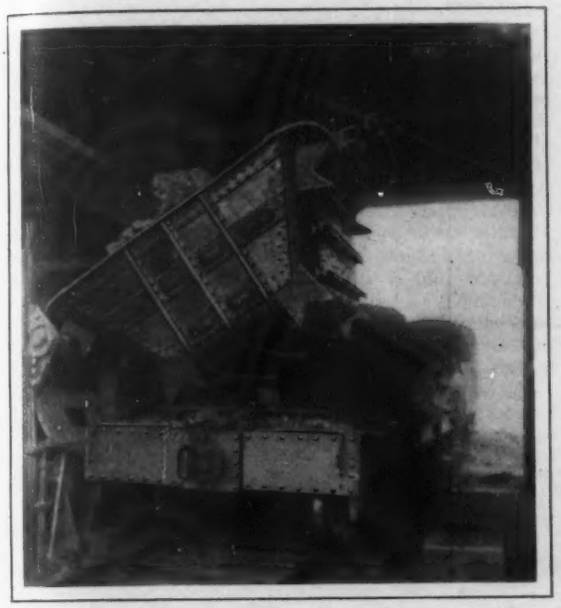


Fig. 1—A Steel Quarry Skip at the Martinsburg Plant of the National Limestone Company Dumping Its Load Into the Hopper Which Opens on the Edison Crushing Rolls 8 or 10 Ft. Below

In the Martinsburg district there are large deposits of very fine limestone, and at this particular plant a large amount of the rock stands in a vertical position, thus making the quarrying operations economical. A 100-ton shovel enables large pieces to be handled and the rock when loaded on special skip cars is drawn by locomotives to the crusher house. These trains consist of from 10 to 15 cars and they are placed so that the rear car is alongside the hopper which leads to the rolls. When this car has been dumped, as is shown in Fig. 1, the train is shifted to bring the next car into the proper position and so on. Because of the character and capacity of the crushing arrangement, no special care is necessary in connection with the dumping of the skip, the load being simply dumped into the hopper, irrespective of whether it consists of one or two enormous blocks or a mixture of large and small stone.

The actual crushing is done by a pair of rolls such as are shown in Fig. 2. Each of these is 6 ft. in diameter and 7 ft. long. Their cylindrical surfaces have numerous projections or knobs arranged in circumferential and longitudinal lines, and all are essentially alike with the exception of those in two longitudinal rows of one of the rolls, the hight of the great majority being approximately 2 in. The arrangement of these knobs is brought out in Fig. 3. The rolls as they rotate cause the knobs to form planes which are inclined toward each other, the angle of inclination to the cylindrical surface not being very steep. The knobs in the two longitudinal rows have rather steep forward faces and are an important factor in breaking up the rock. The arrangement of the circumferential rows is that they are immediately opposite each other, and as the rolls rotate toward each other a kind of V-shaped trough is produced. When running at full speed with no charge of rock between them the regular speed of the rolls is about 465 r.p.m. As the roots of the knobs are 3 ft. from the axis of rotation, the velocity at this point is approximately 35 miles per hr. At any given point where the sluggers pass 330 blows are delivered per min. or 5½ blows per sec., and as there are 8 or 10 sluggers arranged in a longitudinal row it can readily be seen that this is the equivalent of a numerous body of violently active hammers. In addition the sluggers and the other knobs operate with accumulated energy of the weight of the rolls or approximately 50 tons each. These rolls are an invention of Thomas A. Edison and were furnished by the Edison Crushing Roll Company, Stewartsville, N. J. In the original form which was described in *The Iron Age*, October 28, 1897, the knobs on the cylindrical surface had but one size. When a very large rock was fed to two such rolls rotating toward each other it would sometimes ride on the rolls, with the result that the crushing was not satisfactory and there was excessive wear on the projections. The idea was conceived of making some of the projections taller than the others, which is the arrangement followed in the present design.

Each roll rotates on a shaft 21 in. in diameter. A mandrel having an octagonal cross-section is located next to the shaft and upon these surfaces the crusher plates themselves are fastened, ten bolts being used for each plate. The plates measure 22½ in. in width at the base and are 42 in. long. Sixteen of these plates, which vary in thickness from 4 to 5 in. exclusive of the knobs, are used on a single roll. The plates are of chilled cast iron and cast iron is employed for the mandrel. The shafts can be adjusted at various center distances so as to crush the rock to different sizes. When this distance is made a minimum the products of the crushing operation will be sizes ranging from approximately 4 in. down and here the sluggers barely clear the knobs of the opposite roll. If desired the rolls can be placed as far apart as 10¼ in. between centers and the products will then be 2¼ in. and smaller. At the Martinsburg plant large pieces measuring 7 ft. on a side and weighing 28 tons are handled easily. When the rock is fairly gripped both rolls tend to rotate in unison and by reason of the enormous amount of work done in such a short time the rotative speed falls off and then slowly increases. An 8-ton rock can probably be crushed in 13 sec., 10 of which is required to regain speed.

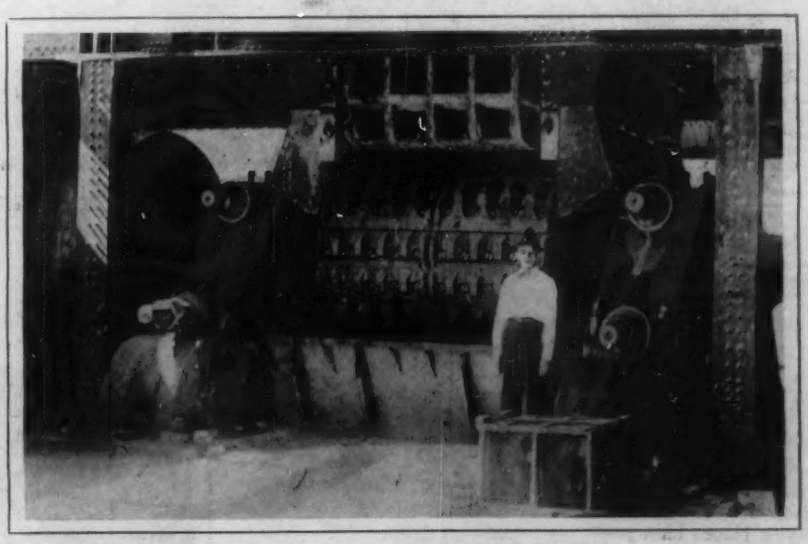


Fig. 2—One of the Pair of Giant Rolls Installed in This Plant by the Edison Crushing Roll Company, Stewartsville, N. J.

The two rolls are not geared together, but are operated independently by separate motors. These motors have a

capacity of 200 hp. and are connected with the rolls by belts 24 in. wide. The motor pulleys are 32 in. in diameter and those on the rolls, 96 in., so that there is the speed reduction of 3 to 1. The roll pulleys are mounted directly

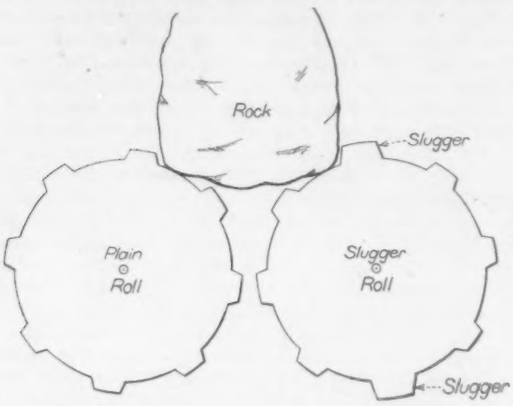


Fig. 3—Section Through the Rolls Showing the Relative Positions of the Knobs on One Roll and the Sluggers on the Other

on the shaft, one on either side of the crusher. The capacity of this plant at present is approximately 1000 tons per hr.

The crusher superstructure and the screen houses, which are of steel with corrugated iron roofing and siding, were erected by W. W. Lindsay & Co., Philadelphia, Pa. The screen house has a total hight of approximately 108 ft. above the surface and contains seven floors, the lower ones being much larger in area than the upper ones. The skip hoists are carried on trusses from the hopper pit under the rolls into the tower portion of the crushing house. The area of the lower portion is approximately 40 x 47 ft., while that of the upper part is much smaller, being only 22 x 38 ft.

In connection with the work of quarrying the limestone the drainage is quite an important problem. Two standard pumps built by the A. S. Cameron Steam Pump Works, New York City, are installed in the quarry for this purpose. One of these has been installed quite recently, but the other one, which has been used day and night for over a year, has seen hard service, and during that time the expense for repairs has been less than $10.

The Dodge Mfg. Company has opened a branch store and warehouse at Fourteenth and Lovejoy streets, Portland, Ore., where a complete stock of Dodge power transmission machinery and appliances will be carried in stock. The branch will be under the management of Charles A. Barnard, formerly vice-president of the Barnard & Meas Mfg. Company, Peoria, Ill., and an engineer of wide experience in mill equipment. The Portland branch will also have the Northwestern sales agency for flouring mill machinery manufactured by the Wolfe Company, Chambersburg, Pa. This makes the tenth branch opened by the Dodge Company, Portland being added to the list in pursuance to a demand. In connection with these several hundred dealers throughout the country carry the full Dodge line in stock.

Woods & Huddart, San Francisco, Cal., manufacturers' agents and jobbers in iron and steel, announce their removal to 444 Market street, that city.

A New Type of Superheater

Details of a Recently Developed Design of the Heine Safety Boiler Company

There are several ways of installing superheaters, among these being the placing of the superheater in the path of the combustion gases after they have passed over a part of the boiler tube surface; installing the superheater in the path of the combustion gases before they enter the fire tubes of a return tubular boiler, and also by replacing a part of the boiler surface by superheater surface, and having the combustion gases rising from the fuel bed in the center divide between the boiler surface on one side and the boiler and superheater surface on the other. Still another method has been followed by the Heine Safety Boiler Company, St. Louis, Mo., in the installation of its new superheater, as is shown in Fig. 1. As will be noticed from Fig. 2, the superheater itself consists of a header box into one side of which are inserted U tubes made of 1½-in. seamless drawn mild steel tubing, expanded into holes provided for them. Hollow staybolts are used in the header and provide a means for introducing a soot blower to keep the exterior surfaces of the superheater tubes free from this material. The header box is divided into three compartments so that the steam makes four passes in flowing over the tube surface.

The superheater is located at one side of the shell at the front of the boiler and a small flue built in the side

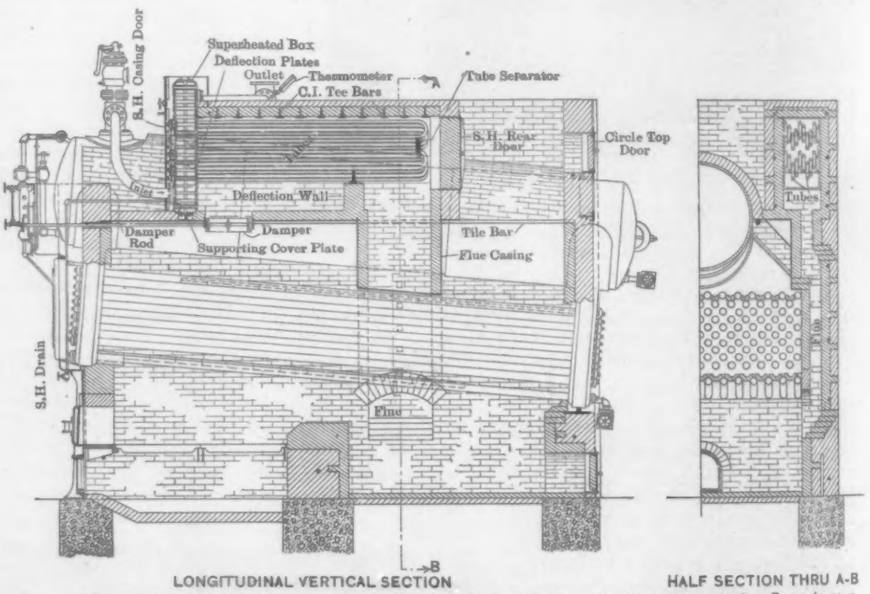


Fig. 1—Longitudinal and Transverse Sectional Elevations Showing the Location of the Superheater, Superheater Flues, Etc., in a Combined Boiler and Superheater Built by the Heine Safety Boiler Company, St. Louis, Mo.

walls of the setting, as shown at the right of Fig. 1, which carries the hot gas from the furnace into the superheater chamber. After passing up this flue, the gases come in contact with only a small part of the boiler surface and

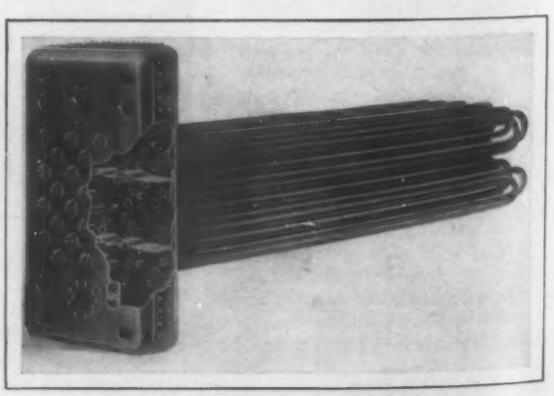


Fig. 2—View of the Superheater Showing the Header Construction and the Diaphragms Directing the Steam Through the Tubes in Four Passes

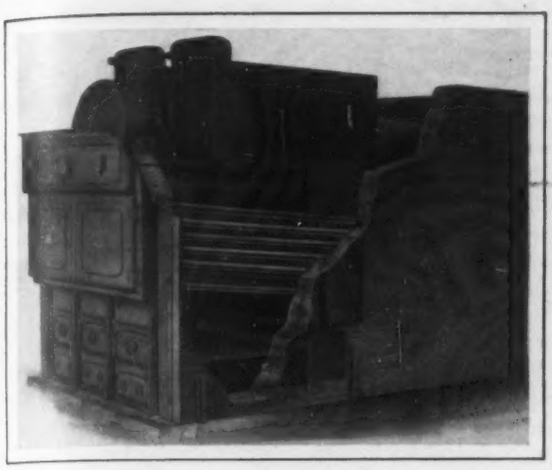


Fig. 3—Arrangement of the Boiler and Superheater Showing the Superheater Flues, the Damper at the Outlet of the Superheater Setting, Etc.

then enter the superheater chamber, making two passes over the superheater surface. In a number of respects this design is similar to an independently fired superheater, which, however, is said to be open to the objection that the control of the steam temperature can only be secured by controlling the combustion. In a superheater of this type the steam supplied must not fall off or else the tubes will be overheated before combustion can be checked and the furnace cooled. It is pointed out that by installing the superheater as shown in Fig. 1, the advantages of an independently fired superheater are obtained without its disadvantages, since a damper in the outlet of the superheater setting controls the volume of hot gases used. In this way it is possible to cut off the flow of combustion gases entirely when either no superheat is desired or when the load is taken off.

This arrangement, which is shown in Fig. 3, it is emphasized, makes it unnecessary to flood the superheater and thus avoids accumulation of mud and scale in the tubes. By setting the damper at different positions, up to the full opening, any desired degree of superheat may be obtained and the damper can be regulated by hand from the front of the boiler or automatically by a simple automatic damper control installed in connection with the superheater.

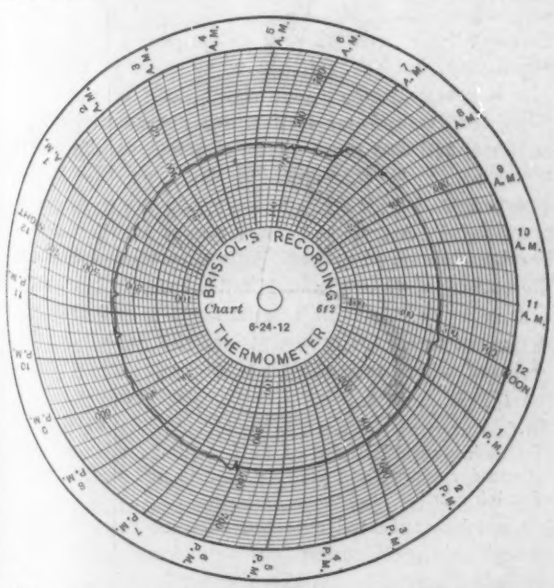


Fig. 4—Reproduction of a Superheater Chart from a Boiler Equipped with a Heine Superheater Showing the Close Regulation of the Superheat Temperature While the Load is On and the Effect of Closing the Damper When the Load is Off

According to a number of tests, including those of the new Grand Central plant, in New York, which contains 6000 hp. of Heine boilers and superheaters, the temperatures of the gases which enter the superheater is approximately 1500 deg. F. The average gas temperature is about 1000 deg. F. and with an average steam temperature of 425 deg., the difference in temperature between the two is 575 deg. With superheaters installed in the path of the boiler gas, the average gas temperature is in the neighborhood of 700 or 800 deg., and the difference in temperature determining the rate of heat transmission is between 275 and 375 deg. F. It will thus be seen that with the first arrangement higher superheats can be obtained and each square foot of superheater surface has a great capacity.

Some idea of the accuracy with which the temperature of the superheat can be controlled is illustrated in Fig. 4, which is a reproduction of a chart obtained in an installation of this type where the temperature was controlled to within 5 deg. of the desired figure. This superheater was in service from 7 a. m. until noon and from 12.30 to 6 p. m. While the load is on, the superheater is automatically controlled with the close regulation indicated by the chart. During the half-hour interval at noon when there is no demand for steam, as well as during the night, the damper is closed. It is pointed out that during these periods flooding is unnecessary and there is no danger of overheating. No steam is flowing through the superheater, which simply acts as an additional steam storage space in which the steam is allowed to accumulate at a temperature slightly higher than that of the boiler. As will be noticed from the chart, the temperature of the steam decreases slowly during the night, indicating that the supply of heat from the hot combustion gases is entirely cut off by the closing of the damper.

Trenton Malleable Iron Company's New Owners

All the stock of the Trenton Malleable Iron Company, Trenton, N. J., has been purchased by the following, who compose the new board of directors: Dr. John H. Murray, president, a leading physician of Trenton, N. J.; James B. Dayton, vice-president, bursar of the Lawrenceville Preparatory Schools; Frank J. Eppele, C.E., secretary and general manager; Arthur Smith, treasurer, cashier of the Trenton Trust & Safe Deposit Company; William H. Schulte, superintendent of the Trenton Brass & Machine Company; Arthur A. Schumann, superintendent of the molding department of the J. L. Mott Iron Works; Harry B. Lapp, superintendent of the DeLaval Steam Turbine Company; Lloyd W. Grover, lumber merchant; Richard C. Chamberlain, councillor-at-law; Edwin D. Bloor, who has been connected with the company for a number of years.

The new company is in the hands of tried business men. The direct management will be under the personal supervision of Frank J. Eppele, who is a man of wide experience in the business, as well as having a thorough knowledge of the requisites necessary to produce an unsurpassed quality of malleable castings. He was one of the founders of the Trenton Malleable Iron Company, which was organized in 1890, and for some years he was the vice-president and general manager of the company. He was also at one time connected with the Troy Malleable Iron Company and later at Bound Brook, N. J. Since severing his former connection with the Trenton Malleable Iron Company he has been county engineer of Mercer County, N. J. Walter H. Burgess, who has had a number of years' experience in the malleable iron business and who had been connected previously with several large malleable foundries, will continue as superintendent.

It is the purpose of the new management to make the principal output of the company malleable and gray iron castings. The facilities of the plant are of the very best, its equipment embodying all modern improvements and appliances, and it will be but a short time until it will again be running to its full capacity.

The General Briquetting Company, 25 Broad street, New York City, controlling in this country the Schumacher briquetting process, is installing a plant at the works of the Lackawanna Steel Company, Lackawanna, N. Y., for the briquetting of blast furnace flue dust. It is expected to have this installation in operation early next month.

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Editors

Geo. W. Cope A. I. Findley W. W. Macon

Charles S. Baur - - *Advertising Manager*

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The Testing Congress

The Sixth Congress of the International Association of Testing Materials, the first to be held on the Western Continent, represented high tide in membership and in number and volume of papers. Never have so many men of large attainment in engineering taken an active part in working out testing problems. The opportunity to visit the American metropolis and later to see something of this country and its industrial development brought nearly 250 Europeans to the New York meeting of last week, and several hundred Americans as against no more than a handful at any preceding congress. Those on whom fell the social responsibilities of the gathering gave full proof of hospitable intent, if their programme stopped somewhat short of European lavishness. In the tour following the technical sessions the visitors obtained quantitative impressions of at least some of the reasons underlying the lively interest of this country in the association's work.

For results in enactments or in important papers dealing with iron and steel, the congress was not remarkable. The presidential address of Professor Howe was pitched on a high plane. It was a veritable classic, showing its author's eminence in letters, as in science. He conceived the testing engineer as one who guards the lives and interests of the public, adding constantly to the amount and certainty of our knowledge of the fit and the unfit among materials of construction. He injected a fine fancy into what in ordinary hands would have been prosaic, in suggesting that in the far future materials will be tested by their action and reaction with some form of energy. In that day, he would have us believe, the testing engineer will still be proving his material by the destructive tests of coupons while he applies to the structures themselves tests which while indestructive will be conclusive.

President Howe recommended that the International Association address itself definitely to specification making, as the American Society for Testing Materials has done. His European confreres, as well as those at home, would assent to the proposal as a generalization, but the rub has come in any attempt to give it practical effect. He rightly says that specifications and methods of testing are necessarily complementary, and that those most competent to improve the latter are most competent to draw up the former. The practical difficulties, however, do not turn on the question of competence. They are of another sort, as has been coming out very plainly in connection with the efforts of Committee 1 of the International Association to establish an international specification for structural steel. In 15 years since the Stockholm Congress, at which the problem was assigned to Committee 1

"to find ways and means for the introduction, on the basis of existing specifications, of uniform international specifications for testing and delivery of iron and steel materials of all kinds,"

it must be confessed that the advance toward an international specification on any form of steel is scarcely discernible. Without going here into the reasons, some of which were referred to in an editorial in *The Iron Age* of June 20, 1912, we place in close proximity to the above assignment to Committee 1 the following action of last week's congress, which represented all that the committee could agree upon as to its important work:

Resolved, In view of the present difficulties attending the preparation of international specifications, the Sixth International Congress recommends to the Council the reference to Committee 1a and Committee 1b, of a continuation of their work by the collection and dissemination of information in regard to the specifications of the different countries; also that these committees be instructed to present their reports to the Council from time to time, waiting for further instructions as to proceeding with the preparation of international specifications.

We shall have further to say on this matter but it may be remarked in passing that the above resolution is couched in terms of euphemism and diplomacy and scarcely indicates how remote is any agreement on international standards for iron and steel.

The dissent of British members of the Committee on Nomenclature from a definition of steel that would rule out the well-known "blister steel" of their country, as well as from the proposal to remove malleable cast iron from the class "cast iron" illustrated the difficulties, commercial and national, involved in attempts to establish a scientific terminology. The special commercial sense in which the term "ingot iron" has found use in this country, and the employment of an equivalent term in some European countries to signify soft steel, also served to cloud the situation as to iron and steel nomenclature and prevent action. There was better success, however, with the nomenclature of microscopic substances and structure in iron and steel, and the results of research in metallography can now be transmitted in well-defined and accredited terminology.

If the Sixth Congress demonstrated the limitations of such international gatherings, it at the same time showed their value, in giving to independent workers in widely separated parts of the world the stimulus of personal contact with the foremost of their kind. It is making progress to discover that on some lines effort for international unification will yield little result and that concentration on others would be wiser. No small service has been done in indicating some directions in which the several strong national testing societies affiliated with the International Association may best carry on their work in the next triennium.

Steel Production in 1912

With commendable promptness the American Iron and Steel Institute has compiled and published the statistics of production of steel ingots and the various forms of rolled iron and steel in the United States in the first half of 1912. This is the first appearance of semi-annual statistics for these products. While the monthly pig iron statement of *The Iron Age* gives the trade some gauge of the expansion and contraction of steel output, ingot statistics are especially desirable and interesting now that the country is producing more steel than pig iron.

As given in our last issue the Institute figures show that the production of steel ingots and castings in the United States in the first six months of 1912 was 14,373,701 gross tons. The pig iron output, as previously reported, was 14,072,274 tons. An excess of 300,000 tons of steel confirms what previous statistics had shown of the increasing preponderance of ingots over pig iron. For the past two and a half years the production figures are as follows in gross tons:

	Pig iron.	Steel ingots.	Excess of pig iron.	Excess of ingots.
1910	27,303,567	26,094,919	1,208,648	.....
1911	23,649,344	23,675,501	.....	26,157
1912 (1st half)	14,072,274	14,373,701	.....	301,427

The figures bear out what market reports have been recording for many weeks of the expansion of the steel side of the industry and, until very recent months, of the backwardness of the foundry trade. The 1910 and 1911 figures reflect in part the increase of pig iron stocks in the former year and their reduction last year, continued in 1912. It is yet a question whether, apart from a period in which stocks of steel products are being rebuilt and stocks of pig iron drawn down, or when merchant iron output falls off, an excess of steel ingots over pig iron will appear in the statistics. In times of prosperity, production of foundry and forge irons may yet exceed the amount of scrap used in open hearth furnaces. The duplex process and the scrap factors come in and are important. Any considerable increase in the amount of steel making material available without recourse to the iron mine or the blast furnace means a steady mitigation of that iron ore scarcity of which something too much has been heard.

One other point comes up in connection with the new steel statistics. Having no half yearly statistics for 1911 for comparison, the compiler assumed that as pig iron output in the second half of that year was less than 3 per cent. beyond that in the first half the steel production in the two halves might be assumed to be about the same. *The Iron Age's* monthly statistics of pig iron production by steel companies will help in getting closer to the steel outputs for the two halves. In the first six months the steel companies produced 7,858,054 tons and in the second half 8,735,391 tons. If the steel ingot output for last year be divided in the same ratio, we should have 11,212,000 tons for the first half and 12,463,000 tons for the second half. The figures would then stand

First half 1911	11,212,000 tons
Second half 1911	12,463,000 tons
First half 1912	14,373,000 tons

The indicated increase of 1,250,000 tons in steel output in the second half of 1911 and the increase of 1,900,000 tons in the first half of 1912 are not out of line with what has been recorded in the market reports of the past year. We have already pointed out that pig iron production in 1912 is likely to exceed 29,000,000 tons. It is entirely within the probabilities that the production of steel ingots and castings will be above 29,500,000 tons and may come close to the 30,000,000 ton mark, which has long been pointed to as one that might be reached in the latter part of the second decade of the century.

The Copper Situation

The report of the Copper Producers' Association, which has just been issued, places the August production of marketable copper in the United States at 145,628,521 pounds, or 65,013 gross tons. This breaks all records for production in this country. The production for the month is at the rate of 780,000 tons per annum. These are extraordinarily large figures. In 1911 the production of copper in the entire world was only 873,460 gross tons, according to the most authentic figures. In that year the output was much the greatest on record. The United States furnished 640,123 tons of the total, also surpassing any previous year. It is hardly to be expected that the rate of production realized in August can be continued month after month. It was probably due to accumulations of raw material at refineries which enabled a much heavier output of refined copper than would be the case under ordinary conditions.

Notwithstanding the tremendous productive rate

attained in August, the stock of copper in this country was reduced that month 3,579,047 pounds, or 1598 tons. This reduction of the stock of copper in the hands of producers, accompanied as it very probably was by a further reduction of the stock in Europe, shows that the world's consumption of copper is much outrunning all past achievements. The predictions of copper authorities, therefore, which were made not many months ago, but at a time when stocks were accumulating, that the time was fast approaching when another extraordinary increase in consumption would be seen, have thus been realized. The increase in this year's output in the United States is greatly needed by the world, as otherwise the price of copper would have gone to an unreasonable hight.

Incidentally, the copper trade presents a concrete fact for the study of those who are now pointing to the tariff as the root of all evils in the United States, including spasms of activity and depression, wide fluctuations in prices and the high cost of living. We are hearing the familiar arguments *ad nauseam* that the tariff is added to the cost of everything; that, with no tariff or a reduced tariff, prices would be much lower than they now are; and further that with no tariff, and our markets open to the world, we would have steadiness in demand and fewer fluctuations in prices. These students of political economy should turn their attention to copper. We have had no tariff duties on copper for years. The ports of this country are wide open for copper to come in or go out. If the arguments of the tariff theorists are correct, copper should have been pre-eminent in its stability and especially in its freedom from any influences causing it to advance to a high price. As far as known there is no copper combination, and if there were our open ports offer the remedy for breaking such a combination which is now so glibly advocated in various quarters. No such condition of stability, however, is seen in the copper trade. The price of copper sunk two years ago to a point which caused many producers to close their mines, notwithstanding the fact that the world's market was open to our copper. On the other hand, we now see prices rising to high figures (now nearly 60 per cent. higher than 15 months ago) with the probability that a still higher point may be reached, and yet there has been no change in the tariff. When will tariff theorists learn that tariffs are but incidental and that market conditions are after all closely governed by the great law of supply and demand?

The New Ohio Constitution

On page 577 in this issue of *The Iron Age* an article appears relative to amendments adopted to the Ohio constitution. Later official election returns indicate that the amendment relating to injunctions was defeated.

The Ashland Steel Company, Ashland, Ky., will close down October 1 for the purpose of installing additional equipment in its plant, included in which are two large reciprocating engines.

The next meeting of the Executive Committee and Administrative Council of the National Metal Trades Association will be held at the Hotel Astor, New York City, October 15 and 16.

The buildings and machinery equipment of the Superior Drop Forge & Mfg. Company, Cleveland, Ohio, offered at a bankruptcy sale September 5 were purchased by the Cleveland Hardware Company for $24,500.

Charles M. Schwab's Views

Charles M. Schwab, president of the Bethlehem Steel Corporation, accompanied by a staff of engineers from the Bethlehem works, sailed for Europe September 5. The trip to Europe, according to the Wall Street Journal, is principally in connection with large European steel orders recently booked by his company, although Mr. Schwab, who will be accompanied by Mrs. Schwab, will confine his stay abroad largely to Carlsbad. He will return early in October. Bethlehem Steel Corporation engineers, including C. A. Buck, general superintendent, R. P. Stout, engineer of ordnance; H. T. Morris of the ordnance department, and S. T. Harleman, superintendent crucible steel department, will visit Greece, Germany, Italy and Sweden in connection with work to be done by the company.

President Schwab leaves for Europe confident that the prosperity which the steel and iron industry is now enjoying in this country will be lasting. He said:

"We could not hope for better steel conditions than now prevail, and there is every indication that the prosperity we are now enjoying will be permanent. The Bethlehem Steel Corporation's plants are operating full. As a matter of fact, there is very little capacity available for additional new business up to the first of next year. Steel orders have been running in excess of production, and new business continues to come in at a gratifying rate. It looks as though the activity the steel companies are now enjoying will continue well into next year. Of course, it is always unsafe to make predictions too far ahead, but the excellent crop outlook and business activity in general forecast continued stable conditions for many months to come.

"In the current year the production of iron and steel will establish a new high record. If we experience good crops next year and nothing disturbing develops in the shape of radical legislation, particularly in connection with the efforts being made to bring about a sharp reduction in steel duties, 1913 should be an even better year in output than 1912. Conditions point to good prices for steel for the rest of the year, but I do not look for, and would not sanction, an upward price movement to a level that would in any way discourage consumption. I believe the majority of steel manufacturers are in favor of prices reasonable to consumer and producer alike, and would not indorse any movement looking toward inflation."

Manchester, England, Buys American Rails

A cablegram from Manchester, England, states that on September 4 the City Council agreed by an overwhelming majority to place an important contract for street rails with the Lorain Steel Company, Johnstown, Pa., whose tender was $51,155, being $4,035 less than the bid of the nearest competitor, a Sheffield concern.

One member of the Council said that while the American tender was cheaper than that from Sheffield, the American goods were equal in quality, and delivery was quicker. Another urged that it would encourage English manufacturers to equip their works on American lines if they got work from English municipalities. A third said English workmen were idle while the Council was sending work to America.

The Council decided that it would be wrong to throw away the ratepayer's money in order to encourage Sheffield manufacturers. The controversy that was started in the debate bids fair to extend all over England, some papers supporting the Council in taking the lowest bid and some indorsing the attitude of the members who declared for the support of home industries.

The Croxton Motor Car Company, Cleveland, Ohio, is building a new plant at Washington, Pa., for the manufacture of motor cars. The Riverside Bridge Company, Martins Ferry, Ohio, has completed the erection of the structural steel work. The main building is a one and two story structure, 120 x 500 ft., and has three bays, each 40 ft. wide. The old plant at Cleveland is being dismantled and the equipment will be shipped to Washington, while some new equipment will be installed. All machines will be motor-driven with purchased power. The output will be taxicabs, touring cars and motor trucks. J. P. Stoltz, Cleveland, Ohio, is president of the company.

A New Record in Lake Ore Shipments

The August figures compiled by the Lake Superior iron shippers show that the movement last month from upper lake docks made the highest total for one month in the history of the trade at 7,760,248 gross tons. July and June were also both above the 7,000,000-ton mark, with 7,567,555 tons and 7,600,283 tons respectively. The total for the season to September 1 was 29,051,152 tons, an increase of 9,445,084 tons over the 1911 total to that date. The attractiveness of grain charters at 2½ cents a bushel from the head of the lakes, equivalent to 94 cents a ton, is limiting the number of wild vessels to be had for the ore trade, and shippers whose wants are not fully covered by the boats they have under contract are naturally somewhat concerned over the situation. The summary of ore shipments by ports is as follows, with comparison with 1911 for August and to September 1:

	August, 1912.	August, 1911.	To Sept. 1, 1912.	To Sept. 1, 1911.
Escanaba	761,717	706,445	3,240,011	2,418,251
Marquette	570,586	357,571	2,001,400	1,200,748
Ashland	761,539	407,578	2,865,397	1,509,841
Superior	2,397,535	1,689,952	9,066,190	6,382,273
Duluth	1,690,650	1,211,667	6,076,452	4,370,117
Two Harbors ..	1,578,221	1,175,098	5,801,702	3,724,838
Total	7,760,248	5,548,311	29,051,152	19,606,068
1912 increase..		2,211,937		9,445,084

By how much the record of 42,618,758 tons shipped by water in 1910 will be broken this year is an interesting question. Probably by 2,000,000 to 3,000,000 tons, from present indications.

American Steel Company Making Wire Nails

The American Steel Company, Park Building, Pittsburgh, bought at sheriff's sale last December the wire nail plant formerly operated by John McCrory & Son at Ellwood City, Pa. It then contained 19 wire nail machines, of which all but 6 were thrown out and 19 new machines were installed. All have since been in steady operation. The company will add 25 more about October 1 and probably 50 more by January 1. The old main building was 50 x 200 ft., but a new and larger building has been added, 50 x 304 ft., in which the new nail machines will be installed, while a part of the building will be used for warehouse purposes. The company manufactures smooth wire nails, galvanized nails, cement-coated nails and special nails. It is contemplated to add several more buildings to the plant. Wire drawing equipment will then be installed, the company at present buying its smooth wire in the open market. It is probable that a part of the equipment of the Griswold Wire Company at Sterling, Ill., will be moved to Ellwood City, and if this is done the company will also produce plain wire, fence wire and barb wire.

Pressed Radiator Company's Reorganization

The plant of the Pressed Radiator Company of America, located at West Pittsburgh, 45 miles from Pittsburgh, on the line of the Pittsburgh & Lake Erie Railroad, was sold at public sale in the courthouse at Pittsburgh on September 5 to F. C. Perkins, representing the bondholders, for $200,000. This sale is the final step in the plan for the reorganization of the company. The plant has been in full operation during the litigation, its output of pressed radiators having been larger in the past few months than ever before. J. K. Frye is president; F. C. Perkins, vice-president; A. M. Pearson, secretary and treasurer, and Charles Sonneborn, superintendent of works. Contracts recently taken cover a wide territory from New York to Iowa. The company has a number of orders for its Seattle, Milwaukee, Kansas City, Winnipeg and other Western branches that will require from 15 to 18 carloads of radiators. Enough work is on hand to keep the plant running at full capacity up to January 1.

The Gardner Machine Company, Beloit, Wis., became September 1 the exclusive distributer and selling agent for the entire output of abrasive disks manufactured by Herman Behr & Co., Inc. The latter firm has made the disks used in the Gardner grinding machines for the past seven years and the relations which have existed between the two companies have been made closer, the Behr factories becoming practically the Gardner Machine Company's plant for the manufacture of abrasive disks.

August Copper Production and Stock

The Copper Producers' Association has issued its monthly statement for August, which makes the following showing compared with July:

	August. Pounds.	July. Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States at first of month.....	50,280,421	44,335,004
Production of marketable copper in the United States from all domestic and foreign sources in the month.....	145,628,521	137,161,129
Deliveries of marketable copper in the month:		
For domestic consumption.....	78,722,418	71,094,381
For export	70,485,150	60,121,331
Total deliveries	149,207,568	131,215,712
Stock of marketable copper of all kinds on hand at all points in the United States at close of month.....	46,701,374	50,280,421

The August production, as given above, was the largest on record, but the deliveries in the month were also phenomenally large, especially for domestic consumption. The net result was a decrease of the stock by 3,579,047 lb. The European stock of copper is again on the decline. Thus consumers are steadily reducing the world's stock.

Carbon-Free Ferrochromium

Adams & Rademacher, Commonwealth Building, Pittsburgh, are agents in the United States for the metal department of the Mark Works, Wengern-Ruhr, Germany. The specialty handled is carbon-free ferrochromium. In recent literature of this product it is stated that while usually ferrochromium contains not less than 0.5 to 0.8 per cent. carbon, together with other impurities, what is now offered is free of carbon as well as of sulphur and phosphorus and contains 60 to 65 per cent. chromium. Microphotographs are reproduced of the structure of high speed tool steel in which the ferrochromium had about 0.8 carbon, the results shown being due to the presence of chromium carbides and metallic oxides. Accompanying them is a view illustrating the structure of steel produced by the addition of carbon-free ferrochromium, this showing a uniform grain. Heat treatment did not vary; the difference is therefore taken to be due entirely to the character of the additions. Contrary to what has been held, it is asserted that the melting point of the carbon-free ferrochromium is considerably lower than that of the product containing carbon.

The Peterson-National Company has been formed by the consolidation of the National Core Oil Company, Buffalo, and the foundry department of the T. J. Peterson Company, Chicago. The consolidated company will manufacture the products of both organizations—core oils, dry core compounds and partings—and later will specialize in all general core room supplies. The two plants will continue in operation, and the branch offices in Cleveland and New York will be maintained. A sales office and warehouse will be opened in San Francisco and arrangements will be made for representation in Canadian and other outside trade. T. J. Peterson is president and general manager; James A. Drake, vice-president, and Henry Adsit Bull, secretary and treasurer. H. S. Peterson is manager of the Chicago plant and George Burman of the Buffalo plant.

International Testing Society at Pittsburgh.—A large number of those who attended the sessions of the International Society for Testing Materials in New York City last week arrived in Pittsburgh September 11, for a two days' visit. The Chamber of Commerce had charge of the welcome and the Pittsburgh entertainment was directed by a committee consisting of W. H. Stevenson, president Chamber of Commerce; John McLeod, Carnegie Steel Company; E. M. Herr, Westinghouse Electric & Mfg. Company; James O. Handy, president Engineers' Society of Western Pennsylvania; John H. Jones, Pittsburgh-Buffalo Company, and W. D. Henry, National Fire Proofing Company. Sub-committees for entertaining the visitors consisted of W. H. Stevenson, chairman reception committee; W. S. Brown, river trip; Taylor Allderdice, automobile trip; William M. Furey, Country Club luncheon, and Col. T. J. Keenan, transportation.

The Iron and Metal Markets

Buying Well Sustained

Advances in Sheets, Steel Pipe and Billets

Export Demand at Much Higher Prices for Southern Iron—Pig Iron Movement Slackening Somewhat

There are no signs of slackening demand for steel products, rather the reverse, and the interest of consumers in next year's business has been sharpened by further price advances. These include $2 a ton on black sheets and $3 on galvanized, though not all producers are yet on the new basis; $2 a ton on some sizes of wrought steel pipe and on steel boiler tubes, and about 50 cents on billets and sheet bars.

The position taken by leading producers in opposition to such prices as might check demand works against any simultaneous scramble by buyers to save themselves from higher prices later. Where the steel companies sell for next year to manufacturing consumers it is to cover well ascertained requirements, and a ban is put on speculation for an advance.

The Steel Corporation's increase of 206,000 tons in unfilled orders in August and the fact that its capacity has been fully taken up for this year on many products indicate heavier bookings for 1913 than has been appreciated. The ability of buyers to contract for forward delivery at 1.30c. Pittsburgh for bars and 1.35c. for plates and shapes is a strong influence against an excited market.

Evidence increases that railroads will be liberal buyers of rails for next year. The B. & O. and the Pennsylvania are now making up their estimates. St. Louis reports 30,000 tons of rails closed this week for 1913. The St. Paul has bought 10,000 tons for early delivery. A southwestern road is in the market for 4200 tons. For export, 18,000 tons is under inquiry for Central America and 8800 tons for the National Railroad of Mexico.

Car orders show some effect of advancing prices and inability to get early deliveries. The B. & O. has placed 2000 gondolas with the Cambria Steel Company. New inquiry reported this week represents about 6000 cars.

The outlook for work requiring plates and structural shapes is excellent. In New Jersey 150,000 tons of steel will be needed for pipe line replacement and new work. Large municipal requirements are coming out in several directions. At Pittsburgh the contract for the Pittsburgh Steel Company's blast furnace ore bins and trestles has just been let calling for 6000 to 7000 tons. In New York the Eighth Regiment Armory, about to be let, will require 8000 tons. Fabricators' bids on good sized contracts still develop keen competition, and there is little danger of soaring prices and curtailed building.

Sheet manufacturers who buy their sheet bars have been slow to sell for next year, but meantime sheets are higher, and this week's advances to 2.15c. Pittsburgh for No. 28 black and 3.30c. for galvanized are expected to be followed by manufacturers generally. A good many sheet mills are oversold. In tin plates the new basis of $3.60 announced by two companies last week is now general.

The strength of the foreign situation in all steel lines is indicated by recent offers of 1.40c. Pittsburgh for skelp to go to England, but deliveries could not be made. There had been previous sales, however, at 1.32½c. Pittsburgh.

Few steel companies now have any semi-finished product to sell for 1912. The Steel Corporation has bought about 30,000 tons recently, including 10,000 tons of open hearth billets this week for a Pittsburgh district mill at close to $25 delivered. Bessemer billets have sold at $24 Pittsburgh and the tendency is still upward. Some sales of Alabama billets have been made in England and Scotland.

The pig iron market shows some flagging in the prodigious buying movement of the past month. In the Central West very large sales were made for next year and leading producers North and South have filled up for most of the first quarter. Eastern Pennsylvania sellers have sold sparingly into next year. On the whole, Northern prices have advanced little in the week.

In Southern iron reports of large inquiries from Europe have caused some excitement. As nearly as can be learned about 15,000 tons of Nos. 3 and 4 has been sold for shipment to Genoa and Trieste, 10,000 tons by one interest. For this year's delivery $12.50 Birmingham was realized on the first sales, and higher prices for later delivery, 3000 tons being sold this week for December, January and February at $13.80 Birmingham for No. 3. London reports of 50,000 tons being under inquiry in the United States to go to Italy are exaggerated, but the demand is not yet satisfied. With prices of Cleveland iron in England advancing spectacularly, Italian buying of Alabama iron is likely to pull up prices here still further.

A sale of 10,000 tons of Southern basic is reported at St. Louis and further business is pending. Southern No. 2 foundry iron has sold at $13 and higher for first quarter and furnaces are now asking $13.50. Some Tennessee iron for this year can still be had on the $12.50 Birmingham basis.

In the Pittsburgh district a sale of 40,000 tons of basic has been made by a western Pennsylvania furnace for this year's delivery. Basic for next year is firmly held at $14.50 at Valley.

English makers of ferromanganese after selling about 8000 tons for next year at $53.50, put their price to $56.50 Baltimore this week.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type. Declines in Italics.

At date, one week, one month and one year previous.

	Sept. 11, 1912.	Sept. 4, 1912.	Aug. 14, 1912.	Sept. 13, 1911.
Pig Iron, Per Gross Ton:				
Foundry No. 2, standard, Philadelphia	**$16.50**	$16.25	$15.75	$15.00
Foundry No. 2, Valley furnace	14.25	14.25	14.00	13.50
Foundry No. 2, Southern, Cincinnati	**15.75**	15.50	15.00	13.25
Foundry No. 2, Birmingham, Ala.	**12.50**	12.25	11.75	10.00
Foundry No. 2, at furnace, Chicago*	15.50	15.50	15.50	14.50
Basic, delivered, eastern Pa.	16.50	16.50	15.75	14.75
Basic, Valley furnace	14.25	14.25	14.00	13.00
Bessemer, Pittsburgh	15.90	15.90	15.40	15.90
Malleable Bessemer, Chicago	15.50	15.50	15.50	14.50
Gray forge, Pittsburgh	14.65	14.65	14.15	13.90
Lake Superior charcoal, Chicago	**16.75**	16.25	16.25	16.50
Billets, etc., Per Gross Ton:				
Bessemer billets, Pittsburgh	**23.50**	23.00	22.00	21.00
Open hearth billets, Pittsburgh	**24.00**	23.50	22.50	21.00
Forging billets, Pittsburgh	**32.00**	29.00	29.00	26.00
Open hearth billets, Philadelphia	**25.90**	25.40	22.40	23.40
Wire rods, Pittsburgh	27.00	27.00	25.50	27.00
Old Material, Per Gross Ton:				
Iron rails, Chicago	16.50	16.50	16.00	14.50
Iron rails, Philadelphia	**17.00**	16.50	16.50	17.00
Car wheels, Chicago	**14.25**	14.00	13.50	12.75
Car wheels, Philadelphia	**14.25**	14.00	14.00	12.75
Heavy steel scrap, Pittsburgh	**14.00**	13.75	13.50	12.75
Heavy steel scrap, Chicago	12.25	12.25	12.00	10.50
Heavy steel scrap, Philadelphia	14.50	14.50	13.75	13.00

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Finished Iron and Steel, Per Pound to Largest Buyers:	Sept. 11, 1912. Cents.	Sept. 4, 1912. Cents.	Aug. 14, 1912. Cents.	Sept. 13, 1911. Cents.
Bessemer rails, heavy, at mill	1.25	1.25	1.25	1.25
Iron bars, Philadelphia	**1.42½**	1.40	1.37½	1.27½
Iron bars, Pittsburgh	**1.50**	1.40	1.40	1.25
Iron bars, Chicago	1.45	1.45	1.40	1.22½
Steel bars, Pittsburgh	1.30	1.30	1.30	1.20
Tank plates, tidewater, New York	1.56	1.56	1.51	1.46
Tank plates, Pittsburgh	1.40	1.40	1.35	1.30
Tank plates, tidewater, New York	1.56	1.56	1.51	1.46
Beams, Pittsburgh	1.35	1.35	1.35	1.35
Beams, tidewater, New York	1.56	1.56	1.51	1.51
Angles, Pittsburgh	1.35	1.35	1.35	1.35
Angles, tidewater, New York	1.56	1.56	1.51	1.51
Skelp, grooved steel, Pittsburgh	**1.30**	1.25	1.25	1.20
Skelp, sheared steel, Pittsburgh	**1.35**	1.30	1.30	1.30
Sheets, Nails and Wire, Per Pound to Largest Buyers:	Cents.	Cents.	Cents.	Cents.
Sheets, black, No. 28, Pittsburgh	2.05	2.05	2.00	1.90
Wire nails, Pittsburgh	1.70	1.70	1.65	1.65
Cut nails, Pittsburgh	1.60	1.60	1.60	1.60
Fence wire, ann'led, 0 to 9, Pgh.	1.50	1.50	1.45	1.50
Barb wire, galv., Pittsburgh	2.00	2.00	1.95	1.95
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt shipment	**$2.25**	$2.15	$2.15	$1.50
Furnace coke, future delivery	2.25	2.25	2.25	1.60
Foundry coke, prompt shipment	2.40	2.40	2.40	1.85
Foundry coke, future delivery	2.50	2.50	2.50	2.10
Metals, Per Pound:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York	17.75	17.75	17.75	12.75
Electrolytic copper, New York	17.62½	17.62½	17.62½	12.37½
Spelter, St. Louis	**7.30**	7.20	7.05	5.90
Spelter, New York	**7.45**	7.35	7.20	6.05
Lead, St. Louis	**4.95**	4.72½	4.35	4.40
Lead, New York	**5.10**	4.85	4.50	4.50
Tin, New York	**48.62½**	47.20	45.87½	39.75
Antimony, Hallett, New York	7.87½	7.87½	7.87½	7.75
Tin plate, 100-lb. box, New York	**$3.84**	$3.74	$3.74	$3.84

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16c.; Philadelphia, 15c.; Boston, 18c.; Buffalo, 11c.; Cleveland, 10c.; Cincinnati, 15c.; Indianapolis, 17c.; Chicago, 18c.; St. Louis, 22½c.; Kansas City, 42½c.; Omaha, 42½c.; St. Paul, 32c.; Denver, 84½c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 80c. on plates, structural shapes and sheets No. 11 and heavier; 85c. on sheets Nos. 12 to 16; 95c. on sheets No. 16 and lighter; 65c. on wrought pipe and boiler tubes.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 1.40c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers, with extras:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated February 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in thick on edge, or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft., down to the weight of 3-16 in., take the price of 3-16 in.

Allowable overweight, whether plates are ordered to gauge or weight, to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras.	Cents per lb.
Gauges under ¼ in. to and including 3-16 in.	.10
Gauges under 3-16 in. to and including No. 8	.15
Gauges under No. 8 to and including No. 9	.25
Gauges under No. 9 to and including No. 10	.30
Gauges under No. 10 to and including No. 12	.40
Sketches (including straight taper plates) 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths or diameters under 3 ft. to 2 ft., inc.	.25
Cutting to lengths or diameters under 2 ft. to 1 ft., inc.	.50
Cutting to lengths or diameters under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Wire Rods and Wire.—Bessemer, open hearth and chain rods, $27. Fence wire, Nos. 0 to 9, per 100 lb., terms 60 days or 2 per cent. discount in 10 days, carload lots to jobbers, annealed, $1.50; galvanized, $1.80. Galvanized barb wire, to jobbers, $2; painted, $1.70. Wire nails to jobbers, $1.70.

The following table gives the price to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12 & 12½	13	14	15	16
Annealed	$1.65	$1.70	$1.75	$1.80	$1.90	$2.00	$2.10	$2.20
Galvanized	1.95	2.00	2.05	2.10	2.20	2.30	2.70	2.80

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in., on one or both legs, ¼ in. and over, and zees, 3 in. and over, 1.35c. Other shapes and sizes are quoted as follows:

	Cents per lb.
I-beams over 15 in.	1.40 to 1.45
H-beams over 18 in.	1.40 to 1.45
Angles over 6 in.	1.40 to 1.45
Angles, 3 in. on one or both legs, less than ¼ in. thick, plus full extras, as per steel bar card Sept. 1, 1909	1.40 to 1.45
Tees, 3 in. and up	1.40 to 1.45
Angles, channels and tees, under 3 in. plus full extras as per steel bar card Sept. 1, 1909	1.40 to 1.45
Deck beams and bulb angles	1.65 to 1.70
Hand rail tees	2.10 to 2.25
Checkered, trough and corrugated floor plates	2.25 to 2.50

Extras for Cutting to Length.

	Cents per lb.
Under 3 ft., to 2 ft. inclusive	.25
Under 2 ft., to 1 ft. inclusive	.50
Under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Sheets.—Makers' prices for mill shipments on sheets of U. S. Standard gauge, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows:

Blue Annealed Sheets.

	Cents per lb.
Nos. 3 to 8	1.45
Nos. 9 and 10	1.50
Nos. 11 and 12	1.55
Nos. 13 and 14	1.60
Nos. 15 and 16	1.70

Box Annealed Sheets, Cold Rolled.

Nos. 10 to 12	1.70 to 1.75
Nos. 13 and 14	1.75 to 1.80
Nos. 15 and 16	1.80 to 1.85
Nos. 17 to 21	1.85 to 1.90
Nos. 22, 23 and 24	1.90 to 1.95
Nos. 25 and 26	1.95 to 2.00
No. 27	2.00 to 2.05
No. 28	2.05 to 2.10
No. 29	2.10 to 2.15
No. 30	2.20 to 2.25

Galvanized Sheets of Black Sheet Gauge.

Nos. 10 and 11	2.15 to 2.20
Nos. 12, 13 and 14	2.25 to 2.30
Nos. 15 and 16	2.40 to 2.45
Nos. 17 to 21	2.55 to 2.60
Nos. 22, 23 and 24	2.65 to 2.70
Nos. 25 and 26	2.85 to 2.90
No. 27	3.00 to 3.05
No. 28	3.15 to 3.20
No. 29	3.25 to 3.30
No. 30	3.45 to 3.50

All above rates on sheets are f.o.b. Pittsburgh, terms 30 days net, or 2 per cent. cash discount in 10 days from date of invoice, as also are the following:

Corrugated Roofing Sheets by Weight.

Effective April 18, 1912, the rates for painted and formed roofing sheets, per 100 lb., are based on the following extras for painting and forming over prices for corresponding gauges in black and galvanized sheets:

	Gauges, cents per 100 lb. 29	25 to 28	19 to 24	12 to 18
Painting.				
Regular or oiling	...	0.15	0.10	0.05
Graphite, regular	...	0.25	0.15	0.10
Forming.				
2, 2½, 3 and 5 in. corrugated	0.05	0.05	0.05	0.05
2 V-crimped, without sticks	0.05	0.05	0.05	...
⅝ to 1¼ in. corrugated	0.10	0.10	0.10	...
3 V-crimped, without sticks	0.10	0.10	0.10	...
Pressed standard seam, with cleats	...	0.15	0.15	...
Plain roll roofing, with or without cleats	0.15	0.15	0.15	...
Plain brick siding	...	0.20	...	...
3-15-in. crimped	0.20	0.20	0.20	...
Weatherboard siding	...	0.25	0.25	...
Beaded ceiling	...	0.25	0.25	...
Rock, face brick and stone siding	...	0.25	0.25	...
Roll and cap roofing, with caps and cleats	0.25	0.25	...	...
Roofing valley, 12 in. and wider	...	0.25	0.25	...
Ridge roll and flashing (plain or corrugated)	...	0.65	0.65	0.65

Boiler Tubes.—Discounts on lap welded steel and standard charcoal iron boiler tubes to jobbers in carloads are as follows:

Steel.		*Standard Charcoal Iron.*	
1⅜ to 2¼ in.	63	1½ in.	46
2½ in.	65½	1¾ to 2¼ in.	48
2¾ to 3¼ in.	70½	2½ in.	53
3½ to 4 in.	73	2¾ to 3¼ in.	55½
5 to 6 in.	65½	3½ to 5 in.	58
7 to 13 in.	63		

Locomotive and steamship special grades bring higher prices.

2½ in. and smaller, over 18 ft., 10 per cent. net extra.
2¾ in. and larger, over 22 ft., 10 per cent. net extra.
Less than carloads will be sold at the delivered discounts for carloads, lowered by two points for lengths 22 ft. and under to destinations east of the Mississippi River; lengths over 22 ft. and all shipments going west of the Mississippi River must be sold f.o.b. mill at Pittsburgh basing discount, lowered by two points.

Wrought Pipe.—The following are the jobbers' carload discounts (card weight) on the Pittsburgh basing card on steel pipe, in effect from July 24, 1912; iron pipe from September 3, 1912, one point greater being allowed on merchant weight.

Butt Weld.

	Steel		Iron	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ in.	72	52	..	..
⅜ in.	73	63	66	50
½ in.	76	66	69	56
¾ to 1¼ in.	79	71	72	61
2 to 3 in.	80	73	73	62

Lap Weld.

1¼ in.	..	..	67	56
2 in.	77	70	69	60
2½ to 4 in.	79	72	71	63
4½ to 6 in.	78	70	70	62
7 to 12 in.	76	66	68	55
13 to 15 in.	53	..	44	..

Plugged and Reamed.

1 to 1½ in., butt weld	77	69	70	59
2 to 3 in., butt weld	78	71	71	60
2 in., lap weld	75	68	67	58
2½ to 4 in., lap weld	77	70	69	61

Butt Weld, extra strong, plain ends, card weight.

⅛, ¼, ⅜ in.	68	58	63	52
½ in.	73	67	67	60
¾ to 1½ in.	77	71	71	62
2 to 3 in.	78	72	72	63

Lap Weld, double extra strong, plain ends, card weight.

1½ in.	..	..	61	53
2 in.	74	68	66	60
2½ to 4 in.	76	70	70	63
4½ to 6 in.	75	69	69	62
7 to 8 in.	68	58	63	53
9 to 12 in.	63	53	58	47

Butt Weld, double extra strong, plain ends, card weight.

½ in.	63	57	57	49
¾ to 1½ in.	66	60	60	52
2 to 2½ in.	68	62	62	54

Lap Weld, double extra strong, plain ends, card weight.

2 in.	64	58	55	49
2½ to 4 in.	66	60	60	54
4½ to 6 in.	65	59	59	53
7 to 8 in.	58	48	52	42

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Pittsburgh

PITTSBURGH, PA., September 11, 1912.

The demand for steel of all kinds seems to be getting heavier instead of falling off, and is running beyond the capacity of the mills. Prices are still rising. Advances in the week include $2 a ton on black sheets and $3 on galvanized, by several of the leading mills, and expected to be made by all the mills before the week is out; $2 a ton on steel boiler tubes; $2 a ton on most sizes of black and galvanized steel pipe, $3 a ton on ferromanganese for first half delivery. The mills are getting further back in deliveries, and buyers are offering heavy premiums for prompt shipments. Most of the leading steel mills are now refusing to sell any more material for delivery this year. Scrap is looking better this week, and coke is also showing signs of an advance.

Pig Iron.—The average price of Bessemer pig iron in August, as compiled by W. P. Snyder & Co., is $14.534 and for basic $14, Valley furnace, but no sales of less than 1000 tons are considered. The supply of available pig iron, especially basic, seems to be getting scarce, and the market is very strong. Last week several sales of Bessemer iron were made at $15, Valley furnace, for this year's delivery, but it is doubtful if this price could now be duplicated, as most makers are quoting $15.50 to $15.75, Valley furnace. The Pittsburgh Steel Company is reported to have made a contract with Corrigan, McKinney & Co. for 40,000 tons of basic for delivery this year. It will be made at Josephine furnace at Josephine, Pa. The price is said to have been about $13.75 at furnace. The Best Mfg. Company is in the market for 10,000 tons of No. 2 foundry for delivery over all of next year. The Westinghouse Machine Company is asking prices on 500 tons of malleable Bessemer for this year. Only a moderate tonnage of pig iron has been sold to Pittsburgh consumers for next year, the higher prices asked by the furnaces causing buyers to hold off. We note sales of 1000 to 1500 tons of basic iron for delivery in first quarter at $14.50, Valley furnace, and 600 tons for October and November at $14.25. A sale of 600 tons No. 2 foundry for November and December delivery is reported at $14.50, Valley furnace, this iron having a high reputation among consumers. The Jones & Laughlin Steel Company will blow in its No. 4 furnace at Aliquippa late this week or early next week. We quote standard Bessemer iron at $15 to $15.25 for remainder of this year and $15.50 to $15.75 for first quarter of next; malleable Bessemer $14.25 to $14.50; basic, $14.25 to $14.50 for remainder of this year; No. 2 foundry, $14.25 to $14.50; gray forge, $13.75, all at Valley furnace, the freight rate to the Pittsburgh district being 90c. a ton.

Steel Billets and Sheet Bars.—High prices are being offered for open hearth billets and sheet bars, and in most cases without getting the steel. A local interest of the Steel Corporation bought last week 10,000 tons of open hearth steel billets from a mill outside of the Pittsburgh district, for which it paid $25 delivered, the steel netting the seller about $24.25 at mill. A local concern making cold rolled strip steel bought last week from an open hearth steel plant 1000 tons of small billets for which it paid $27 delivered, part being shipped this week, thus paying a heavy premium for prompt delivery. A sale of 500 tons of open hearth sheet bars was made for delivery at Canonsburg, Pa., at $26 delivered, equal to about $25.25 Pittsburgh. Nearly all the large consumers are trying to buy from the small outside plants, but in most cases are unsuccessful. The Republic Iron & Steel Company is absolutely out of the market for this year as a seller of either Bessemer or open hearth steel in the form of billets or sheet bars. About all the steel that can be obtained now is in the hands of dealers, and they are asking premiums of $1 to $2 a ton over what the mills would probably quote if they had the steel to spare. We quote as follows: Bessemer billets, $23.50 to $24; Bessemer sheet bars, $24 to $24.50; open hearth billets, $24 to $24.50, and open hearth sheet bars, $24.50 to $25, all f.o.b., Pittsburgh or Youngstown mills. Axle billets are higher, and we quote these at $29 to $30, and forging billets for general forging purposes at $32 f.o.b. cars at mill, Pittsburgh.

Ferroalloys.—Effective September 9, prices on English 80 per cent. ferromanganese for first half of 1913 were advanced $3 a ton, or from $53.50 to $56.50, Baltimore. English makers are reported to have withdrawn from the market for this year, and any lots for such shipment will be resales by dealers or brokers. We quote 80 per cent. ferromanganese for this year $55 to $56, and for next year $56.50, Baltimore, the rate for delivery in the Pittsburgh district being $1.95 a ton. We quote 50 per cent. ferrosilicon in lots up to 100 tons at $72.50; over 100 tons to 600 tons, $71.50, and over 600 tons, $70.50, Pittsburgh. The lower grades are ruling at $20 for 10 per cent., $21 for 11 per cent. and $22 for 12 per cent., f.o.b. cars at Ashland, Ky., or Jackson, Ohio. On ferrotitanium we quote 8c. per lb. for carload lots, 10c. per lb. in 2000-lb. lots and over and 12½c. per lb. in lots up to 2000 lb.

Steel Rails.—Sales have been made at the new prices on light rails, which are being firmly held. As yet the Carnegie Steel Company has not booked any orders for heavy rails for delivery next year, but is receiving liberal specifications on contracts for this year. The company received new orders and specifications in the past week for about 3000 tons of light rails and continues to book good orders for both standard sections and light rails for export. It is still rolling open hearth rails at its Ohio works. We quote splice bars at 1.50c. per lb. and standard section rails at 1.25c. per lb. Effective September 5, light rails will be advanced to the following prices: 25, 30, 35, 40 and 45 lb. sections, 1.25c.; 16 and 20 lb., 1.30c.; 12 and 14 lb., 1.35c., and 8 and 10 lb., 1.40c., all in carload lots f.o.b. Pittsburgh.

Wire Rods.—The new demand is quiet. We note a sale of 400 tons of high carbon rods at $29, Pittsburgh, these taking a differential of $2. We quote Bessemer, open hearth and chain rods at $27, Pittsburgh.

Muck Bar.—Two local consumers that have been trying to buy 2000 to 2500 tons have so far been unsuccessful. It is probable they will buy Eastern muck bar. The Kittanning Iron & Steel Mfg. Company, which has 33 puddling furnaces, is running only about half on account of the scarcity of puddlers. Standard grade muck bar is very firm at $31, Pittsburgh.

Skelp.—The market is very strong. We note sales of 8000 to 10,000 tons of grooved steel skelp at prices ranging from 1.30c. to 1.35c., delivered buyer's mill. We now quote grooved steel skelp at 1.30c. to 1.35c.; sheared steel skelp 1.35c. to 1.40c.; grooved iron skelp 1.60c. to 1.65c., and sheared iron skelp 1.75c. to 1.80c. delivered at buyer's mill in the Pittsburgh district.

Structural Material.—The local fabricating interests are not booking much new business, being practically filled up for the next three or four months. The McClintic-Marshall Construction Company has taken 6000 to 7000 tons for ore bins and trestles for the Pittsburgh Steel Company's new blast furnaces at Monessen, Pa., and 400 tons for new buildings for the Quigley Foundry & Machine Company, Chicago, and the American Bridge Company has taken 725 tons for bridge work for the Wabash Railroad. Considerably higher prices are being quoted on new fabricated work. Prices on plain material are very strong, the minimum price of the Carnegie Steel Company on beams and channels being 1.35c. and of the Jones & Laughlin Steel Company 1.40c. We quote beams and channels up to 15 in. at 1.35c. to 1.40c., Pittsburgh.

Plates.—More steel car orders came out in the past week than for some time, and large inquiries are pending. The Cambria Steel Company has taken 2000 gondolas for the Baltimore & Ohio and 400 steel hopper cars for the Cambria & Indiana. The Chicago, Burlington & Quincy is reported to have placed 1000 gondolas and the Pittsburgh, Shawmut & Northern 250 hopper cars with the American Car & Foundry Company. The Carolina, Clinchfield & Ohio is in the market for 400 box cars and the Santa Fé for 50 ore cars. Specifications against contracts for plates continue to pour into the mills and they are steadily getting further behind in deliveries. As high as 1.50c. is being paid for plates for delivery within three or four weeks. The Carnegie Steel Company is still naming 1.35c. on ¼ in. and heavier, but will not promise deliveries before next year. We quote ¼ in. and heavier plates at 1.35c. to 1.40c. for shipment at convenience of the mill, and 1.50c. or higher for delivery within three or four weeks.

Iron and Steel Bars.—The Republic Iron & Steel Company is out of the market as a seller of steel bars for delivery this year, and the Jones & Laughlin and Carnegie companies will not promise deliveries on new contracts much short of 1913. The makers of iron bars have advanced prices and the market is strong at 1.50c. to 1.55c. Consumers are willing to pay $1 to $2 a ton premium for shipment within three or four weeks, but in most cases their orders were turned down. We quote merchant steel bars at 1.30c. to 1.35c. on new orders for shipment at convenience of the mill, and 1.40c. to 1.50c. for delivery within three or four weeks.

Sheets.—Effective September 10, several makers advanced prices on box annealed, one-pass, cold rolled sheets $2 a ton, and galvanized $3 a ton, making the base price of No. 28 black sheets 2.15c. and 28 galvanized 3.30c. Whether this advance will be followed by the other mills has not yet been determined. A very large tonnage of black sheets has been offered mills in the Pittsburgh district for delivery in the first quarter of 1913 at 2.10c. base for No. 28, one-pass, cold rolled, but the business was declined. Some sheet makers will have to distribute their estimated production pro rata among old customers so great is the demand. The advance in galvanized sheets by several of the leading makers is referred to as being fully justified by the fact that spelter is quoted at the highest price that it has reached in a good many years. We note a sale of 2000 tons of No. 10 gauge blue annealed sheets for this year's delivery at 1.50c. maker's mill, Pittsburgh. It is likely that the advance of $2 on black and $3 on galvanized will be the minimum of the market within a short time.

Tin Plate.—Other makers have fallen in line, and now the minimum price of tin plate is $3.60 per base box, and for delivery over the remainder of this year only. Some large consumers are still importuning the mills to accept orders for first quarter and first half at the $3.60 price, but this business is being declined. All the tin plate mills are running to utmost capacity, and there is still a considerable scarcity in the supply of steel. We now quote tin plate at $3.60 per box for 14 x 20 coke plates, f.o.b. Pittsburgh, for this year.

Bolts and Rivets.—The new demand continues heavy and the recent higher prices named by the makers of bolts and rivets are being firmly held. Several makers will not accept new orders for delivery before December or January. Prices will probably be further advanced in the near future on account of the higher prices charged for steel. We quote button head structural rivets at $1.90 per 100 lb. base, and cone head boiler rivets at $2 in carloads only, an advance of 10c. to 15c. being charged for smaller lots. New discounts on bolts are as follows: Coach and lag screws, 80 and 12½ per cent. off; small carriage bolts, cut threads, 75, 10 and 7½ per cent. off; small carriage bolts, rolled threads, 75, 10, 10 and 2½ per cent. off; large carriage bolts, 70, 10 and 5 per cent. off; small machine bolts, rolled threads, 75, 10, 10 and 7½ per cent. off; small machine bolts, cut threads, 75, 10, 10 and 2½ per cent. off; large machine bolts, 70, 10 and 10 per cent. off; square hot pressed nuts, blank and tapped, $6 off, and hexagon nuts, $6.70 off. These prices are in lots of 300 lb. or over, delivered within a 20c. freight radius of maker's works.

Hoops and Bands.—New orders are fairly heavy and specifications against contracts are coming in freely, all makers being back in deliveries four to eight weeks or longer. We quote steel bands at 1.30c. to 1.35c., with extras as per the steel bar card, and hoops at 1.40c. to 1.45c. f.o.b. Pittsburgh. Two leading mills are holding steel bands at 1.35c. and steel hoops at 1.45c. minimum.

Shafting.—Makers report that the recent advance of $2 a ton is being firmly held and some business has been taken at the higher price. All the makers of shafting are badly oversold and are back in deliveries four to six weeks or longer. It is probable that prices will again be advanced in the near future. We quote cold rolled shafting at 62 per cent. off in carloads and 57 per cent. in less than carloads delivered in base territory.

Spelter.—The market continues to advance, prime grades of Western being quoted at 7.32c. East St. Louis, equal to 7.45c. Pittsburgh. Still higher prices are predicted.

Railroad Spikes.—Specifications against contracts continue to come in freely, but new buying is light, as most consumers are well covered. Prices are very firm. We quote railroad spikes in base sizes, 5½ by 9/16 in., also small railroad and boat spikes, at $1.75 per 100 lbs. f.o.b. Pittsburgh. It is said that $1.80 for standard sizes of railroad spikes has been offered for prompt delivery and declined.

Wire Products.—The new demand for wire and wire nails is only fairly active, most consumers having covered prior to the recent advance. The new demand for barb and fence wire is getting heavier, indicating that fall trade is opening up. Prices are firm. We quote wire nails at $1.70 per keg; cut nails $1.60 to $1.65; galvanized barb wire, per 100 lb., $2; painted, $1.70; annealed fence wire $1.50, and galvanized fence wire $1.80 f.o.b. Pittsburgh, usual terms, freight added to point of delivery. Jobbers charge the usual advances over these prices for small lots from store.

Merchant Steel.—The new demand is fairly active, specifications against contracts are coming in freely, and prices are firm. Leading makers are badly oversold and are from 8 to 10 weeks back in deliveries. We quote: Iron finished tire, 1½ to ⅜ in. and larger, 1.30c., base; under ⅜ in., 1.40c.; planished tire, 1.50c.; channel tire, ¾, ⅞ and 1 in., 1.80c.; 1⅛ in. and larger, 1.65c.; toe calk, 1.85c., base; flat sleigh shoe, 1.35c.; concave and convex, 1.70c.; cutter shoes, tapered or bent, 2.30c.; spring steel, 1.90c.; machinery steel, smooth finish, 1.70c., all f.o.b. cars, Pittsburgh.

Merchant Pipe.—Effective September 10 the National Tube Company issued a new card of discounts on steel pipe on which advances have been made of one point, or $2 a ton, on most sizes, up to 11 points, or $22 a ton, on ⅛-in. galvanized, but this size is not in great demand. The new card is said to be more a readjustment of discounts than an advance. Spang, Chalfant & Co., Inc., have also issued a new card of discounts on iron pipe effective September 3, in which discounts have been shortened one point, the advance being equal to $2 a ton. The new demand for merchant pipe continues heavy and all the mills are practically sold up for the remainder of this year.

Boiler Tubes.—Under date of September 10 the National Tube Company issued a new card on boiler tubes in which discounts were shortened one point, the advance being equal to $2 a ton. The new demand for merchant and boiler tubes has been very heavy for some time.

Coke.—The new demand for coke has shown some improvement. Inquiries are out for a considerable tonnage of blast furnace coke for delivery over the remainder of this year. One leading coke company reports that it was offered $2.50 for furnace coke for such delivery. Prompt furnace coke is firm at $2.25 and sales of 8000 to 10,000 tons are reported at $2.25 to $2.35 per net ton at oven. We quote standard makes of furnace coke for prompt shipment at $2.25 to $2.35, at oven, and for remainder of the year at $2.25 to $2.50. Standard makes of 72-hr. foundry coke for prompt shipment are held at about $2.40 to $2.50 and for remainder of the year from

$2.50 to $2.75 per net ton at oven. The output in the upper and lower Connellsville regions last week was 371,915 net tons, a gain over the previous week of 2797 tons.

Iron and Steel Scrap.—The market has shown some betterment and prices of heavy steel scrap are now firm on the basis of $14, Pittsburgh. A local consumer reports having bought 2000 tons or more of selected heavy steel scrap in the past week at this price. Prices are also stronger on the other grades. The enormous consumption which is steadily going on makes the chances favor the dealers getting higher prices in the near future. There is a good deal of tonnage of low phosphorus melting stock changing hands and prices are very strong at $16.25 to $16.50, delivered. Borings and turnings are still somewhat quiet, due to the fact that two of the leading consumers, the West Penn Steel Company and the Allegheny Steel Company, are pretty well filled for some time ahead. Dealers quote as follows, per gross ton:

Heavy steel scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen and Pittsburgh delivery	$14.00
No. 1 foundry cast	$13.25 to 13.50
No. 2 foundry cast	12.00 to 12.25
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	12.25 to 12.50
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	15.00 to 15.25
No. 1 railroad malleable stock	13.00 to 13.25
Grate bars	9.75 to 10.00
Low phosphorus melting stock	16.25 to 16.35
Iron car axles	24.50 to 25.00
Steel car axles	16.50 to 16.75
Locomotive axles	25.00 to 25.50
No. 1 busheling scrap	12.50 to 12.75
No. 2 busheling scrap	8.50 to 8.75
Old car wheels	14.00 to 14.25
*Cast iron borings	9.75
*Machine shop turnings	10.50 to 10.75
†Sheet bar crop ends	15.00 to 15.25
Old iron rails	15.75 to 16.00
No. 1 R. R. wrought scrap	14.75 to 15.00
Heavy steel axle turnings	11.00 to 11.25
Stove plate	10.25 to 10.50

*These prices are f.o.b. cars at consumers' mills in the Pittsburgh district.
†Shipping point.

Chicago

CHICAGO, ILL., September 10, 1912.

In the matter of prices the current market evidences a wide range of possibilities. A conservative sentiment fostered by the leading interest, whose mills are filled with orders, is represented by an adherence to what may be termed regular prices, while those mills representing the other extreme, and to whom present conditions in the iron and steel trade constitute a harvest, are asking and generally obtaining premiums ranging from $2 to $6 per ton. This applies to structural shapes, plates, sheets and bars. Railroads are continuing active negotiations for rails and track fastenings. In other finished lines new business is surprisingly heavy and represents an aggregate equal to if not greater than the current output of the mills. An attempt is being made by producers to avoid the consideration of business for next year, but in some instances small tonnages of shapes, bars and sheets have been placed at decided advances in price. The buying movement in pig iron has not yet spent itself. Some apprehension is being felt both by the steel and pig iron interests because of the imminent car shortage which daily grows more apparent. Furnace interests are also concerned with regard to the uncertainty of a sufficient Lake shipment of ore before the close of navigation.

Pig Iron.—The spirited buying of pig iron shows practically no signs of abatement. The closing of large tonnages in one quarter is immediately succeeded by new inquiries of like importance elsewhere, and melters who considered themselves well supplied last week are this week in the market with urgent demands for hundreds of tons to cover new orders for castings received meanwhile. The business taken by the Lake furnaces for shipment over the remainder of the year places them under necessity of shipping an average daily tonnage which even now is being seriously curtailed because of an inability to obtain cars. For this reason alone the situation has in it possibilities of serious dedays. Lake traffic likewise is causing considerable uneasiness. The movement of ore, even if unhampered, will hardly meet requirements and already the necessity for moving grain is making inroads on the available ore carrying capacity. A late closing of navigation is almost imperative. What now seems like an ample unfilled furnace capacity may become, to a large extent, nominal. Current prices continue firmly on the basis of $16 f.o.b. local furnace, with the selling interests increasingly inclined to ask an advance for second quarter and first half shipment. The position of the Birmingham furnaces is equally firm, and there is little if any Southern iron available at less than $13 for No. 2. Some quotations for high phosphorus or resale iron have preserved a $12.50 price in the market, but this has little significance. For first quarter two interests have advanced their price to $13.50, but no sales are recorded at that level. Ohio irons, which have been quoted on the basis of $14.50, Ironton, have been withdrawn from this market on that basis and charcoal iron is quoted at the minimum price of $16.75 for prompt shipment, with an advance of 50c. for first quarter. We quote local irons, f.o.b. furnace, the average switching charge to Chicago foundries being nearly 50c. per ton. Other quotations are for Chicago delivery. Prices on prompt shipment are as follows:

Lake Superior charcoal	$16.75 to $17.25
Northern coke foundry, No. 1	16.00 to 16.50
Northern coke foundry, No. 2	15.50 to 16.00
Northern coke foundry, No. 3	15.00 to 15.50
Northern Scotch, No. 1	16.50 to 17.00
Southern coke, No. 1 foundry and No. 1 soft	17.35 to 17.85
Southern coke, No. 2 foundry and No. 2 soft	16.85 to 17.35
Southern coke, No. 3	16.60 to 16.85
Southern coke, No. 4	16.35 to 16.60
Southern gray forge	16.10 to 16.35
Southern mottled	16.10 to 16.35
Malleable Bessemer	15.50 to 16.00
Standard Bessemer	16.75
Basic	15.50 to 16.00
Jackson County and Kentucky silvery, 6 per cent.	17.90
Jackson County and Kentucky silvery, 8 per cent.	18.90
Jackson County and Kentucky silvery, 10 per cent.	19.90

Rails and Track Supplies.—Western railroads continue to give active attention to their rail requirements for next year, although during the past week the prompt shipment inquiries attracted considerable interest. The Pere Marquette placed an order for 9000 tons of open hearth rails with the Cambria Steel Company for immediate shipment and the Cotton Belt Road is inquiring for 10,000 tons for similar delivery. An Iowa railroad placed 5000 tons with the Illinois Steel Company. The lack of steel is curtailing the output of the Gary mills nearly 50 per cent., which is typical of the open-hearth rail mill situation elsewhere. In various instances Bessemer titanium specifications are being substituted for open hearth, and as a result the South Works is running practically at full capacity. There is a heavy railroad inquiry for spikes and track bolts, all of the leading trunk lines being in the market for both immediate and future deliveries. Current market quotations show considerable variation, reflecting Eastern prices on such business as cannot be taken care of by local mills because of delivery. Prices equivalent to 1.83c. and 1.85c. Chicago are noted. We quote standard railroad spikes at 1.80c. to 1.85c., base; track bolts with square nuts, 2.20c., base, all in carload lots, Chicago; tie plates, $30 net ton; standard section Bessemer rails, Chicago, 1.25c., base; open hearth, 1.34c.; light rails, 25 to 45 lb., 1.20c. to 1.25c.; 16 to 20 lb., 1.25c. to 1.30c.; 12 lb., 1.30c. to 1.35c.; 8 lb., 1.35c. to 1.40c.; angle bars, 1.50c., Chicago.

Structural Material.—Recent contracts for fabricated steel include 631 tons for the Southern Traction Company of Texas to the Virginia Bridge & Iron Company; 274 tons for the Northern Pacific, 200 tons for the Chicago, St. Paul, Minneapolis & Omaha, 400 tons for the Pere Marquette, and 298 tons of plate girders for the city of Chicago, to the Central States Bridge Company; 810 tons for a bridge approach at St. Louis to the American Bridge Company; 224 tons for the Locomotive Superheater Company to the Kenwood Bridge Company; 2268 tons for bridges in Minneapolis to the Modern Steel Structural Company, and 74 tons for the Hotel Gibson, Cincinnati, to the Potthaft Construction Company of that city. The market for plain material has not essentially changed, except in the greater prevalence of premium prices for prompt shipment. An order for 800 tons placed at Chicago brought 1.50c. Pittsburgh, which price represents the average basis upon which business can be placed, if at all. Some tonnage in structural material has been reserved for next year without a price, but for the most part mills are avoiding customers' attempts to place orders for this delivery. We quote for Chicago delivery, mill shipment, on plain shapes, 1.58c. to 1.68c. and from store 1.95c.

Plates.—Inquiries for plates for prompt shipment have brought out quotations varying from 1.40c. to 1.60c. Pittsburgh, and deliveries ranging from 10 days to six weeks. The leading interest continues to adhere to its 1.35c. price, although this is rendered ineffective by reason of the condition of its mills. Most

other large makers are adhering to the basis of 1.40c. and are avoiding premiums. Quotations from other sources are generally on the basis of premiums from $2 to $4 per ton. All sources of plates considered, there is little choice between universal and sheared plates as regards their availability and price. The Missouri, Kansas & Texas Railway is in the market for 50 locomotives. We quote for Chicago delivery, mill shipment, 1.58c. to 1.68c., and from store 1.95c.

Sheets.—The market for sheets has grown exceedingly firm, particularly as regards plain black and galvanized, for which most of the mills are asking an advance of $2 a ton above our minimum quotation. Such quotations as have been made for first quarter shipment have been $3 above this minimum. Blue annealed sheets are not so firmly held. The rapid advance in the price of spelter has raised the cost of galvanized sheets out of proportion to the market, and one of the leading mills in this territory has withdrawn all prices on galvanized. Store prices were advanced during the week $3 to $4 a ton. We quote, Chicago delivery, as follows: Carload lots, from mill, No. 28 black sheets, 2.23c. to 2.33c.; No. 28 galvanized, 3.33c. to 3.43c.; No. 10 blue annealed, 1.68c. to 1.73c. Prices from store are: No. 10, 2.15c.; No. 12, 2.20c.; No. 28 black, 2.75c., and No. 28 galvanized, 3.80c.

Bars.—Extensive railroad inquiry for bar iron is current both for forward delivery and for prompt shipment. The latter demand has arisen very largely because of the failure of the railroads to obtain deliveries upon the schedules promised, necessitating their coming into the market to meet needs for which they had already contracted. With reference to steel bars the same situation applies as with regard to other steel products, prices ranging from the nominal basis of 1.30c. Pittsburgh, to prices carrying premiums of $2 and $3 per ton. Adverse mill conditions, as a result of the extreme heat, have seriously curtailed operating schedules. This is particularly true of bar iron and hard steel bars. Users of these materials are in many cases seriously handicapped by shortages of stock. We quote as follows: Bar iron, 1.45c.; hard steel bars, 1.40c. to 1.45c.; soft steel bars, 1.48c. to 1.58c., and from store, soft steel bars, 1.85c., Chicago.

Rivets and Bolts.—While the volume of new business in rivets and bolts is not large, the new prices are apparently being maintained with considerable firmness. The unusual spread between the prices at which the various rivet makers are selling continues to obtain, each adhering to his own schedule. We quote as follows: Carriage bolts up to ⅜ in. x 6 in., rolled thread, 75-10-10-2½; cut thread, 75-10-7½; larger sizes, 70-10-5; machine bolts up to ⅜ in. x 4 in., rolled thread, 75-10-10-7½; cut thread, 75-10-10-2½; larger sizes, 75 and 10; coach screws, 80-12½; hot pressed nuts, square head, $6.00 off per cwt.; hexagon, $6.70 off per cwt. Structural rivets, ¾ to 1¼ in., 1.98c. to 2.08c., base, Chicago, in carload lots; boiler rivets, 0.10c. additional.

Wire Products.—An exceedingly heavy movement in wire products is under way, particularly in the building up of warehouse stocks and the accumulating of supplies by manufacturers. Retailers as well are preparing for a subsequent sale of large proportions. The extent of buying is dependent upon necessities which diminish the importance of price, and as a result the recent advance in quotations is being adhered to consistently. We quote as follows: Plain wire, No. 9, and coarser, base, $1.68 wire nails, $1.88; painted barb wire, $1.88 to $1.93; galvanized, $2.18; polished staples, $1.93; galvanized, $2.23, all Chicago.

Cast Iron Pipe.—At Appleton, Wis., a contract for 1600 tons of pipe was awarded the past week. Municipal lettings scheduled for this coming week include 500 tons at Olney, Ill., and 2500 tons at Dayton, Ohio. Waterworks improvements are under consideration at Moline, Ill.; Cloquet, Minn.; Polk County, Iowa., and Portland, Texas. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $30; 6 to 12 in., $28; 16 in. and up, $27, with $1 extra for gas pipe.

Old Material.—The local scrap market appears to have gained some additional strength, and consumers have gradually conceded higher quotations. Where any considerable tonnage has been available melters have been particularly willing to pay slight advances in order to protect themselves against further rises in value with as large a supply as possible. Dealers, however, are holding old material in their hands until forced to move it, seeking to obtain the advantage of each day's possible advance. As a result a considerably restricted movement of scrap is noted. On the other hand the principal buyer of heavy melting steel continues its embargo on scrap. Current railroad offerings include 1200 tons by the Chicago, Milwaukee & St. Paul, 800 tons by the Wabash and a blank list by the Lake Shore, Michigan & Southern. We quote for delivery at buyer's works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton.	
Old iron rails	$16.50 to $17.00
Old steel rails, rerolling	14.50 to 15.00
Old steel rails, less than 3 ft	13.00 to 13.50
Relaying rails, standard section, subject to inspection	24.00
Old car wheels	14.25 to 14.75
Heavy melting steel scrap	12.25 to 12.75
Frogs, switches and guards, cut apart	12.25 to 12.75
Shoveling steel	12.00 to 12.50
Steel axle turnings	9.75 to 10.25
Per Net Ton.	
Iron angles and splice bars	$15.00 to $15.50
Iron arch bars and transoms	16.25 to 16.75
Steel angle bars	12.00 to 12.50
Iron car axles	20.75 to 21.25
Steel car axles	16.25 to 16.75
No. 1 railroad wrought	12.75 to 13.25
No. 2 railroad wrought	11.75 to 12.25
Cut forge	11.75 to 12.25
Steel knuckles and couplers	11.75 to 12.25
Steel springs	12.25 to 12.75
Locomotive tires, smooth	13.25 to 13.75
Machine shop turnings	7.75 to 8.25
Cast and mixed borings	6.75 to 7.25
No. 1 busheling	10.75 to 11.25
No. 2 busheling	8.00 to 8.50
No. 1 boilers, cut to sheets and rings	8.50 to 9.00
Boiler punchings	12.50 to 13.00
No. 1 cast scrap	12.25 to 12.75
Stove plate and light cast scrap	10.50 to 11.00
Railroad malleable	12.50 to 13.00
Agricultural malleable	10.75 to 11.25
Pipes and flues	9.75 to 10.25

Philadelphia

PHILADELPHIA, PA., September 10, 1912.

The market throughout is firm and active, with strong tendencies in most directions to advance prices. Premiums are offered freely for finished materials and mills are getting further behind in their deliveries. Rolling schedules are being stretched as far as possible to accommodate conditions, and mill stocks are almost entirely depleted. Sales from stocks have been made at advances from $2 to $6 over present quotations, which for the most part are purely nominal because of the deferred delivery promises. The pig iron market is undergoing rapid changes, and, while no large sales have been reported, furnaces are looking forward to increased activity as soon as they are able to ascertain with any degree of accuracy their probable costs on raw material after the first of the year. Several sales of foreign ores are reported for next year's delivery. There has been some business in export iron, and an inquiry for 7000 tons of heavy T rails for export is noted, as well as 8800 tons of heavy rails for the National Railroad of Mexico and 4200 tons for a Southwestern railroad. The Great Northern bought 5000 tons of rails and the Baltimore & Ohio 2000 hopper gondola cars.

Iron Ore.—An active movement in the purchase of foreign iron ores culminated the past week with the sale of 35,000 tons of second quality El Cuero Cuban ore for next year's delivery at 8c. per unit and 30,000 tons of Cuban Daiquiri ore for prompt delivery at 7¼c. per unit, this establishing an advance of three-quarters of a cent per unit, or nearly 50c. per ton over former sales. A sale of 12,000 tons of El Cuero low phosphorus ore at 9½c. per unit for first quarter delivery is also noted. This quotation is f.o.b. cars at Philadelphia. Transatlantic foreign ores are scarce and prices high, due to the combined conditions of better European demands and higher ocean freights. Charter rates for vessels in this trade are so high as to practically prohibit new business on Mediterranean ores. An inclination has developed among buyers to cover more fully for requirements for the remainder of the year, but sellers are not anxious to quote either for last quarter or into next year. Importations in the week included 20,800 tons of Cuban, 6580 tons of Swedish, 17,720 tons of Newfoundland, 105 tons of German and 24 tons of Spanish ore.

Pig Iron.—The most interesting development in the local market has been the action of Virginia furnaces. The leading interest on Monday withdrew all quotations on business offered for the remainder of this year or the first quarter of next, and on Tuesday re-entered the market for the first quarter with a quotation of $14.25, furnace, or equal to $17.05 delivered in Philadelphia territory on No. 2 X, at the same time announcing that it still had a fair tonnage of the lower grades. Immediately after the advice reached

local representatives two sales amounting to slightly over 1000 tons of Virginia No. 2 X were made at the advance and several pending deals are expected to go through within the next two or three days. Another Virginia company which has hitherto refused to quote on first quarter made a sale of 1200 tons of No. 2 X at $14.50 furnace for shipment into Chicago territory. There is a strong inclination among consumers of foundry grades to contract for a considerable period ahead, but furnaces have not been in a position, because of the uncertainty regarding the cost of raw material, to make a quotation. It is thought the action of the Virginia company in announcing its intention to accept business on the basis of $14.25 furnace may ease the situation and start things off on a larger scale for the first quarter. The market on basic iron has been quiet, and the impression is prevalent that the large consumers have fully covered on their requirements for the last quarter of this year and well into the first quarter of next year. The outstanding inquiry is between 5000 and 10,000 tons. No important sales of pipe iron are reported, and the largest interest is not expected to be in the market for several weks at least. Furnace reports show a material decrease in stocks both at eastern Pennsylvania and Virginia furnaces, while orders, on the other hand, have increased, making the situation stronger from the furnace standpoint. The quotations on Virginia No. 2 plain show a differential of 50c. per ton instead of the usual 25c. for last quarter as an incentive to move the lower grades, but first quarter quotations are back to the 25c. differential, or $14, furnace. Eastern Pennsylvania No. 2 X foundry iron stiffened up and the majority of sellers are quoting $16.50 to $16.75 delivered in Philadelphia. Low phosphorus pig iron is in fair demand, and while the ruling quotation is $21.50, the sale of a fair tonnage for export into Canada is noted at a slightly higher price. The following range of prices represents the market for standard brands, delivery in buyers' yards through the remainder of the year:

Eastern Pennsylvania No. 2 X foundry	$16.50 to $16.75
Eastern Pennsylvania No. 2 plain	16.25 to 16.50
Virginia No. 2 X foundry	17.05 to 17.25
Virginia No. 2 plain	16.55 to 16.75
Gray forge	15.75 to 16.00
Basic	16.50
Standard low phosphorus	21.50

Billets.—Eastern steel makers are sold up to what they consider their safety limit on semi-finished steel and are not seeking any new business; the only new contracts being taken on for anything like nearby delivery have been largely as a favor to old customers who underspecified for their requirements. The nominal minimum for rolling billets is $25.90, with forging billets quoted at a minimum of $30. Premiums of $2 to $4 a ton have been paid, but whenever they can consistently do so mills are refusing to consider this class of business.

Structural Material.—The volume of specifications against mill orders continues exceedingly heavy. The first week in September, from a mill standpoint, has been equally as good as the first week in August. Few new projects have come out, but shop operations on former contracts have fabricators booked up at least until the first of the year, at which time they anticipate a heavy movement for spring building. The unusual feature in this market the past week has been that Western buyers have come here looking for material and offering $5 per ton premium for prompt deliveries. The nominal market on shapes is 1.55c. to 1.60c., although shipments from mill stocks have been made up to 1.75c. One of the new projects being considered in this district is a concrete and steel pier, calling for 1200 tons of shapes, opposite the Hotel Rudolph, Atlantic City, N. J.

Plates.—The volume of business, both in new orders and specifications against former contracts, continues very heavy, and one Eastern interest has advanced its price to cover the remainder of the year, the new quotations being 1.55c. for sheared and 1.60c for universal plates, for shipment in September; 1.60c. for sheared and 1.65c. for universal, for shipment in October, and 1.65c. for sheared and 1.70c. for universal for shipment in November and December. These prices cover only contracts for immediate specifications, and a premium of $5 a ton over these figures is being asked from other than regular customers. Two shipyards have an inquiry in for plates and have asked to be protected on contracts now being figured for new ships.

Sheets.—The market is exceedingly firm, with a tendency to advance. Mills are unable to meet the demands of their customers, and we note an inquiry for a large tonnage of stamping sheets from Detroit automobile manufacturers, who are unable to secure their full requirements in the Western market. The minimum on blue annealed is 1.75c., Philadelphia, on which mills are obtaining from $2 to $5 a ton premium. Eastern makers of sheets, 18 to 28 gauge, are securing an advance of ¼c. to ½c. per lb. over Pittsburgh base prices plus freight for prompt shipment.

Old Material.—Most of the steel works which were in the market two weeks ago have covered for their requirements for some considerable time ahead and the market is less active, but prices are strong with a tendency to advance. The cheap scrap seems to have disappeared, and the range of quotations is therefore more restricted. The Southern Railway scrap list, which closes September 12, is considerably larger than usual, as is also the case of the Lackawanna list, which is now out. The Pennsylvania list has been closed, but awards have not been announced. No large tonnages of heavy steel scrap have been moved since the last report, and dealers are not crowding the market. The following prices represent the market for deliveries in buyers' yards in eastern Pennsylvania and nearby points, taking a freight rate ranging from 35c. to $1.35 per gross ton:

No. 1 heavy melting steel scrap and crops	$14.50 to $15.00
Old steel rails, rerolling (nominal)	16.00 to 16.50
Low phosphorus heavy melting steel scrap	17.75 to 18.25
Old steel axles	18.00 to 18.50
Old iron axles	24.00 to 25.00
Old iron rails (nominal)	17.00 to 17.50
Old car wheels	14.25 to 14.75
No. 1 railroad wrought	16.25 to 16.75
Wrought iron pipe	13.25 to 13.50
No. 1 forge fire	12.50 to 13.00
No. 2 light iron (nominal)	7.50 to 8.00
Wrought turnings	11.00 to 11.50
Cast borings	10.00 to 10.25
Machinery cast	14.00 to 14.50
Grate bars, railroad	10.75 to 11.25
Stove plate	10.75 to 11.25
Railroad malleable (nominal)	12.50 to 13.00

Ferroalloys.—The market on ferromanganese has taken a quick upturn and all old quotations have been withdrawn. Importers have refused to quote on future delivery. We note the sale of two cars of 80 per cent. ferromanganese at $59, seaboard, and quotations of $56.50 for first half of next year are subject to cable confirmation. Ferrosilicon is quoted at $24.55, delivered, for 11 per cent. and $72.50, delivered, for 50 per cent.

Bars.—The demand for steel bars has been decidedly active, but sales have for the most part been of small tonnages with insistent pleas for early deliveries. Mills are filled up for a long period ahead and are avoiding making delivery promises wherever possible, some manufacturers having arrived at the point where they are not soliciting business and will not consider new customers even at the premiums that are being offered. Regular business ranges in price from 1.40c., Pittsburgh, for new business in steel bars with reasonable deliveries to 1.50c. for prompt business when sizes are in stock. While it is possible that 1.42½c. could be done on iron bars the general asking price is 1.45c. to 1.47½c., delivered in this district.

Coke.—Floods and high water in some parts of the coke region, with the resultant decrease in production, have in a measure stiffened the price of prompt coke, and although there are a few quotations at $2.25, at oven, the prevailing price for forward shipment ranges from $2.35 to $2.50, with stock coke quoted at $1.95. The following range of prices per net ton represents the market for deliveries in this district:

Connellsville furnace coke	$4.50 to $4.70
Connellsville foundry coke	4.90 to 5.00
Mountain furnace coke	3.70 to 4.20
Mountain foundry coke	4.15 to 4.30

Cleveland

CLEVELAND, OHIO, September 10, 1912.

Iron Ore.—The buying during the past month has resulted in the cleaning up of about all available ore that is at all desirable. Some of the ore firms have practically nothing to offer and one has advanced prices on some non-Bessemer ore that is still available. Offers of better prices than present quotations would probably bring out some ore, but shippers already have about all on their books that they can move this season. While shippers are pretty well covered with vessel tonnage for ore already sold, recent efforts to get vessels at regular rates, except for immediate cargoes, have been unsuccessful and ore firms would doubtless have to pay an advance in freight rates for additional tonnage. In fact, offers of higher rates have been made.

This advance in carrying charges would be borne by the buyer of the ore. Previous records were again broken in ore shipments in August when 7,760,248 gross tons was brought down the lakes. The movement in June, the previous record month, was 7,600,283 tons. The total to September 1 was 29,051,162 tons as compared with 19,606,068 tons in the corresponding period a year ago and 28,827,029 tons up to September 1, 1910. In 1910 the season's movement reached 42,691,000 tons. Late estimates indicate that shipments this year will exceed 44,000,000 tons. Of the total shipments in August Lake Erie ports received 6,075,673 tons. Shipping schedules have been badly disarranged during the last few days by a strike of the employees of the Great Northern docks at Superior. It is reported to be settled by a compromise giving the employees an advance of 20 cents a day. We quote prices as follows: Old Range Bessemer, $3.75; Mesaba Bessemer, $3.50; Old Range non-Bessemer, $3.05; Mesaba non-Bessemer, $2.85.

Pig Iron.—Cleveland agencies have this week sold a heavy tonnage of foundry grades for delivery during the first half. Round tonnages brought prices indicating a very firm market. Some of the largest consumers have purchased about all they will need for their first half requirements. Business in this territory is fairly active but melters do not seem so anxious to buy as in outlying districts. The local market is firm at $15 at furnace for No. 2 foundry, for any delivery. One local furnace has nothing to sell for this year's delivery. In the Valley a Cleveland interest which advanced its price to $14.75 for No. 2 for next year's delivery reports the sale of considerable tonnage at that price. We note one sale of 2000 tons of No. 2 foundry for northern Ohio shipment for the first half, which was divided between two Cleveland furnaces, part of it at $14.75, furnace, and part of it at $15. The same buyer purchased 1200 tons of No. 2 Southern at $13, Birmingham. Another sale reported is 1300 tons of No. 2 Northern to a Cleveland consumer at $15 for the first half. A north central Ohio manufacturer has bought 500 tons of No. 3 foundry from a southern Ohio producer at slightly under $14 at furnace. We also note the sale of 1500 tons of Southern charcoal in northern Ohio at $22.50. Southern iron is firm, most makers in the Alabama district now quoting $13, Birmingham. Tennessee iron can be had at about $12.50. Northern furnacemen are expecting an advance in ore prices for next season, but are at present taking no interest in the situation. It is believed that many have over-bought ore owing to the low prices that prevailed this year and that few will need any of the 1913 ore for their pig iron production in the last month or two of the first half. For prompt shipment and the remainder of the year we quote, delivered Cleveland, as follows:

Bessemer	$15.90
Basic	$15.00 to 15.25
Northern No. 2 foundry	15.00 to 15.25
Southern No. 2 foundry	16.85 to 17.10
Jackson County silver, 8 per cent. silicon	18.05

Coke.—The market is inactive but firm. Some consumers are feeling around for prices for next year's delivery, but so far they have been unable to secure quotations. Sales of furnace grades for prompt shipment are reported at $2.35 to $2.40 at oven. We quote standard Connellsville furnace coke at $2.25 to $2.30 per net ton at oven. Foundry coke is held at $2.50 to $2.75 for standard 72-hour grades.

Finished Iron and Steel.—There is considerable inquiry for finished material for next year's delivery, but mills generally have not yet opened their books for 1913 contracts. Specifications continue heavy and mills are getting in no better shape on deliveries. There is considerable new inquiry, part of which is coming from consumers who are unable to get material from mills with which they have contracts. Local mills have little to offer in steel and iron bars for this year's delivery. We note the sale of 500 tons of steel bars, shapes and plates, shipment of which is not promised before December, at 1.35c., Pittsburgh, for bars and 1.40c. for plates and shapes. High premiums are being paid for steel bars for early delivery. An Eastern mill is selling structural material in this market at 1.50c. at mill for quick shipment or $2 above its price for future delivery. Iron bars are quoted at 1.45c. to 1.50c., Cleveland. The demand for structural material is very heavy. While not much new work has come out recently some of the local fabricators have so much work on hand that they cannot bid on new jobs. The McMyler Interstate Company, Bedford, Ohio, has taken 1200 tons for the new forge shop of the Upson Nut Company, Cleveland. The demand for sheets is heavy and prices are very firm. Considerable inquiry is coming out for billets for next year's delivery. One quotation is reported at a considerable advance over present prices. Forging billets are scarce and an Eastern mill is taking orders in this market on the basis of $31.50, Pittsburgh, for car lots.

Old Material.—Considerable sales have been made recently for delivery in the remainder of the year and the market at present is fairly active. Some dealers are looking for better prices soon and will not sell short. Railroad lists out this week include the Lake Shore, Pennsylvania Lines and Michigan Central. The market is firm, with price quotations generally unchanged. Dealers prices, f.o.b. Cleveland, are as follows:

Per Gross Ton.

Old steel rails, rerolling	$14.00 to $14.50
Old iron rails	14.00 to 14.50
Steel car axles	18.50 to 19.00
Heavy melting steel	13.00 to 13.25
Old car wheels	13.00 to 13.50
Relaying rails, 50 lb. and over	22.00 to 22.50
Agricultural malleable	10.50 to 11.00
Railroad malleable	13.00 to 13.25
Light bundled sheet scrap	10.00 to 10.50

Per Net Ton.

Iron car axles	$18.50 to $19.00
Cast borings	7.50 to 7.75
Iron and steel turnings and drillings	8.00 to 8.25
Steel axle turnings	8.50 to 8.75
No. 1 busheling	11.00 to 11.25
No. 1 railroad wrought	12.50 to 13.00
No. 1 cast	11.50 to 12.00
Stove plate	9.50 to 10.00
Bundled tin scrap	11.00 to 11.50

Cincinnati

CINCINNATI, OHIO, September 11, 1912.—(*By Telegraph.*)

Pig Iron.—Although inquiries are not so numerous, a lot of quiet buying is being done in this section, most of which is for forward delivery. Consumers have generally accepted the prediction of higher prices for first half business, and those who have not already covered for that period are now trying to get under cover at last week's quotations. A local melter was able to close last week for 600 tons of Northern No. 2 foundry at $14.50, Ironton, for first half, and it is also reported that several central Ohio and Indiana consumers succeeded in booking for their first half requirements at the same price, but the bulk of sales for that delivery are on the basis of $15, Ironton. Order books are so comfortably filled that a few producers have withdrawn from the market and the minimum quotation for next year's business is $15, with $15.50 asked in a number of instances. The Southern situation is much stronger, and only a limited quantity of No. 2 foundry is now available at $12.50, Birmingham, for this year's shipment. For first and second quarter delivery $13 to $13.50 represents average quotations, and a few small sales at the latter price have been made. The central Ohio inquiry for 1500 tons of Northern No. 2 foundry has been closed and another melter in the same territory bought approximately 1000 tons of mixed Northern and Southern. Malleable continues in fairly good demand, which is somewhat phenomenal, considering the heavy buying during the past 30 days. Two Ohio manufacturers took 1000 tons each and a West Virginia melter also purchased a like quantity, all for first half. A local agency booked 1500 tons of Southern charcoal iron in the Pittsburgh district, to be shipped during the next six months, and a Michigan melter took a small quantity of Lake Superior charcoal for first half shipment. A nearby stovemaker is in the market for a round tonnage of Southern foundry iron, and there are a number of scattered inquiries from central Ohio and Indiana for both Northern and Southern grades. Based on freight rates of $3.25 from Birmingham and $1.20 from Ironton we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 foundry and 1 soft	$16.00 to $16.50
Southern coke, No. 2 foundry and 2 soft	15.75 to 16.25
Southern coke, No. 3 foundry	15.25 to 15.50
Southern coke, No. 4 foundry	15.00 to 15.25
Southern gray forge	15.00 to 15.25
Ohio silvery, 8 per cent. silicon	17.70 to 18.20
Southern Ohio coke, No. 1	15.95 to 16.40
Southern Ohio coke, No. 2	15.70 to 16.20
Southern Ohio coke, No. 3	15.20 to 15.70
Southern Ohio malleable Bessemer	15.70
Basic, Northern	15.20 to 15.70
Standard Southern car wheel	25.75 to 26.00
Lake Superior charcoal	17.25

(By Mail)

Coke.—In all three districts oven operators are having a difficult time in making shipments on contracts to suit the wishes of purchasers, and as a consequence there is not much of an effort put forth to

take on new business. Wise County and Pocahontas prices are hardening, and in the latter district there is very little furnace or foundry coke to offer. Connellsville operators are also taking advantage of the activity with iron producers. In all three fields 48-hr. coke is quoted around $2.25 to $2.50, the latter figure representing the average contract price, although a considerable quantity of Connellsville furnace coke was sold in the Central West recently around $2.40 per net ton at oven. Foundry coke also shows a tendency to advance, and while some spot shipment orders have lately been placed for small tonnages as low as $2.60 per net ton at oven, the average prompt shipment quotation is $2.75, with the majority of producers asking a premium of about 10c. to 25c. a ton. Cars are getting scarcer every day, and a large number of the foundries in this vicinity are endeavoring to accumulate coke in anticipation of a still further shortage in rolling stock later on.

Finished Material.—Structural material appears to be in the lead, but there is considerable complaint over the inability of the mills to make deliveries wanted by purchasers. Sheets also continue very active, and it is no uncommon occurrence with the local mill to receive requests for doubling the tonnages on contracts previously sent out for signature. It is predicted here that another advance on both galvanized and black sheets will occur within a few days. The mill price on steel bars is from 1.30c. to 1.35c., and on structural material 1.40c. to 1.45c., Pittsburgh basis, with the latter figures governing the majority of transactions made. Local warehouse prices on steel bars have advanced to 1.85c. to 1.90c., and on structural material around 2c. to 2.05c. Wire nails are in better demand. The mills are not soliciting business for next year's delivery on many finished steel products.

Old Material.—With the exception of a much better call for relaying rails, there is no change in the local market. It is hard to quote relaying rails, as the price depends on the quantity and size that the customer wants; as well as the location of delivery point. Cast borings and turnings both show improvement, and the prices named below are firm on every class of scrap material. The minimum figures represent what buyers are willing to pay for delivery in their yards, southern Ohio and Cincinnati, and the maximum quotations are dealers' prices f. o. b. at yards:

Per Gross Ton.

Bundled sheet scrap	$9.50 to $10.00
Old iron rails	13.25 to 13.75
Relaying rails, 50 lb. and up	20.75 to 21.75
Rerolling steel rails	11.50 to 12.00
Melting steel rails	10.50 to 11.00
Old car wheels	12.50 to 13.00

Per Net Ton.

No. 1 railroad wrought	$11.00 to $11.50
Cast borings	6.50 to 7.00
Steel turnings	7.25 to 7.75
No. 1 cast scrap	11.00 to 11.50
Burnt scrap	7.75 to 8.25
Old iron axles	17.25 to 17.75
Locomotive tires (smooth inside)	12.00 to 12.50
Pipes and flues	7.25 to 7.75
Malleable scrap	8.75 to 9.25
Railroad tank and sheet scrap	6.75 to 7.25

Birmingham

BIRMINGHAM, ALA., September 9, 1912.

Pig Iron.—The feature of the week is the export business done. Strictly Birmingham prices are being secured on iron sold for shipment to Mediterranean points. One company has sold 10,000 tons to Trieste and Genoa, and another furnace interest is reported as trying to buy iron to fill its Mediterranean contracts, offering $12.50 for Nos. 3 and 4. The lower grades of iron were principally demanded in Mediterranean contracts. The Sloss-Sheffield Steel & Iron Company announces that it has advanced prices for the rest of this year to $13, and for delivery in 1913 to $13.50. This company still has 36,000 tons on its yards, and hence its announcements as to price are regarded as significant. It is estimated that 125,000 tons for 1913 delivery was sold by Birmingham makers at $12.50, after which they advanced to $13. During the week offers of $13 for 1913 have been declined. The Sloss-Sheffield alone sold 52,000 tons in August, and reports the sale of 15,000 tons in the first week of September. At present it is operating only three furnaces with a monthly production of 25,000 tons. Stocks on hand in all yards were still further reduced in August. A leading interest is credited with being sold well into the first half of next year. Several are sold into the first quarter. One interest, which has led in the advance of prices, declares it has no more iron to sell under $13.50. It reports one sale at that figure for 1913 delivery last week, with total sales of 2000 tons in odd lots. The average price was $13 and it was for all deliveries through the first quarter of 1913. Buyers and sellers continue to accept the situation as one of a gradually advancing tendency. It is difficult to see anything but further advances. There is little iron for 1913 to be had under $13.50 unless regular customers are the applicants. Prices f.o.b. cars at Birmingham for rest of the year and 1913 respectively are asked and, it is understood, generally obtained on the following basis:

No. 1 foundry and No. 1 soft	$13.50 to $14.00
No. 2 foundry and No. 2 soft	13.00 to 13.50
No. 3 foundry	12.50 to 12.75
No. 4 foundry	12.00 to 12.50
Gray forge	11.50 to 12.00
Basic	12.50 to 13.00
Charcoal	22.50

Cast Iron Pipe.—Manufacturers of small sizes of cast iron pipe are especially busy, but all pipe makers continue to receive orders besides running actively on contracts previously taken. Shipments would be heavier in pipe as well as in pig iron but for car shortage. Prices are maintained as follows, per net ton: 4-in., $25; 6-in. and over, $23, with $1 per ton added for gas pipe.

Old Material.—Dealers are enjoying a good trade and prices are firm. The dismantling of the rolling mill of the Republic Iron & Steel Company at Gate City has added to the material on hand. Inquiry for all grades is stronger, and the firmness of the pig iron market finds its reflection in that of old material. Prices quoted by dealers, per gross ton, f.o.b. cars, Birmingham yards, are unchanged as follows:

Wrought iron car axles	$15.00 to $16.00
Old steel axles	13.50 to 14.50
Old iron rails	..... 13.50
No. 1 railroad wrought	11.00 to 11.50
No. 2 railroad wrought	..... 10.00
No. 1 country wrought	8.50 to 9.00
No. 2 country wrought	8.00 to 8.50
No. 1 machinery	9.00 to 9.50
No. 1 steel	9.50 to 10.00
Tram car wheels	10.00 to 10.50
Standard car wheels	10.50 to 11.50
Light cast and stove plate	7.00 to 7.50

Coal and Coke.—Both the steam coal and domestic coal markets have improved, with a complaint of car shortage. The Pratt Consolidated will build two collieries at Mobile and otherwise enlarge its bunker coal trade. Standard coke has advanced to $3.50 to $4 per net ton at oven: The outlook is very good.

St. Louis

ST. LOUIS, MO., September 9, 1912.

The buying movement in general throughout all the divisions of the market has continued at the pace of late weeks. Buyers seem to feel it wiser to contract now than to risk higher prices; in consequence nothing has occurred to check the tendency to provide for future needs.

Pig Iron.—The aggregate of purchases has been maintained on a parity with preceding periods. The orders have varied somewhat in individual size, but the sum total has been as high as ever. One of the interesting features of the past few days has been the number of inquiries coming out without quantities attached, but from sources which would unquestionably buy in large lots. One of the largest purchases reported is of 10,000 tons of Southern basic by an enameling company. Other individual purchases include one of 700 tons of Northern iron, another of 600 tons Northern and several of smaller quantities. A sale of 1000 tons of Northern iron was also made to an Atchison consumer. The small buyers are still active in filling their wants and their aggregate will run into very satisfactory figures. The inquiries, aside from those indefinite as to quantity, include one for 2000 tons, one for 1000 tons and one for 600 tons of No. 2 Southern, all for first half delivery. The quotation for Southern No. 2 foundry, Birmingham basis, is $13 to $13.50 for first quarter delivery, with no disposition to hold down that figure for first half. Ohio iron is quoted here at $14.50 to $15, with the latter the better figure to depend upon. Chicago No. 2 X is held here at $16, at furnace. Expectations are for further advances, and one furnace in the Birmingham district has already sent notice to that effect.

Coke.—There is no present activity in coke except for specifications on contracts. The movement under this head continues large, evidencing the needs of the melters, but new contracts are not appearing. By-prod-

uct coke is for the present out of the market and no quotations are being made.

Finished Iron and Steel.—Buyers in the finished product division have evidently reached the conclusion that they must begin to prepare for next year, and the specifications during the week on structural material especially have been heavy. Many have specified 50 per cent. beyond their contracts and others are keeping well up with the leaders, thus aiding the mills to plan for 1913.

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Old Material.—In the scrap market there is continued activity and accompanying increases in price. There is heavy demand from the foundries and steel mills, and generally the needs are appearing to be in excess of the available supplies. Relaying rails are still much desired and hard to get. Rerolling rails are very strong at the prices quoted. Lists out during the week include 300 tons from the Vandalia, 500 tons from the Mobile & Ohio and 500 tons from the Alton. We quote dealers' prices, f.o.b. St. Louis, as follows:

Per Gross Ton.	
Old iron rails	$15.00 to $15.50
Old steel rails, rerolling	13.25 to 13.75
Old steel rails, less than 3 ft.	12.00 to 12.50
Relaying rails, standard section, subject to inspection	23.00 to 23.50
Old car wheels	15.00 to 15.50
Heavy melting steel scrap	11.75 to 12.25
Frogs, switches and guards cut apart	11.75 to 12.25
Per Net Ton.	
Iron fish plates	$13.00 to $13.50
Iron car axles	19.25 to 19.75
Steel car axles	16.75 to 17.25
No. 1 railroad wrought	11.50 to 12.00
No. 2 railroad wrought	11.00 to 11.50
Railway springs	10.75 to 11.25
Locomotive tires, smooth	13.00 to 13.50
No. 1 dealers' forge	9.00 to 9.50
Mixed borings	7.00 to 7.50
No. 1 busheling	10.00 to 10.50
No. 1 boilers, cut to sheets and rings	8.00 to 8.50
No. 1 cast scrap	11.75 to 12.25
Stove plate and light cast scrap	9.00 to 9.50
Railroad malleable	10.25 to 10.75
Agricultural malleable	9.25 to 9.75
Pipes and flues	8.00 to 8.50
Railroad sheet and tank scrap	8.00 to 8.50
Railroad grate bars	9.25 to 9.75
Machine shop turnings	7.50 to 8.00

German Market Strength Continues

Scarcity of Semi-Finished Steel More Pronounced

BERLIN, August 29, 1912.

The firmness of prices continues and work in all lines is proceeding at full speed. Fewer price advances have been reported than in the past few weeks, and where they have been made it has been merely to even up prices with those in other sections of the country.

Exporters and wholesalers in the Silesian district have been placing large contracts for the rest of this year, so far as the works are able to accommodate new orders. The scarcity of semi-finished steel has grown more pronounced and some of the consuming works have been not a little hampered by lack of material. Inquiries from England and other countries are accumulating from day to day, and latterly large buying has been effected by Oriental countries. These latter are taking not only the ordinary rolled products but structural supplies, tubing and steel plates. The demand for heavy and thinner plates is so heavy that the mills are continually striving to increase their producing capacity. Orders for railroad supplies are unusually heavy, and steel tubing goes into consumption as fast as it can be turned out. In this connection it may be mentioned that a great Rhenish establishment has just succeeded in capturing a large order (several million marks) from the Japanese Government for structural supplies in competition with American bidders.

The efforts to prolong the Wire Rod Association have reached a deadlock owing to the excessive quotas claimed by several companies. It is now proposed that it be extended for about a half-year to give time for further negotiations.

Talk of Organizing the Bar Trade

The idea of organizing the bar trade is still entertained among western works. A movement is reported as being on foot there to secure the services of General-Director Lob, formerly manager of the Hohenlohe (zinc) works in Upper Silesia, to undertake the organization and management of a bar combination. He had an active part in organizing the Steel Works Union, and is regarded as especially fitted to bring the bar mills together. As the shipments of bars will this year exceed 4,000,000 tons, this has become the most important section of the German iron trade. It is doing unusually well at the present price level, and the feeling is that now is a favorable moment to effect an organization for maintaining prices, since, when a reaction in the general trade does set in, bars will be the first product to feel the change.

The stock markets continue to take an optimistic view of the iron trade prospects. One of the great banks of Berlin, in its most recent circular to country customers, mentioned the splendid position of the iron trade, adding that dealers who had hitherto hesitated about placing orders have recently been buying more freely, and that this was also the case with consumers themselves. The circular further points out that the iron companies are now deriving advantages from the improvements that they have been making in their plants within the past few years, by which their competing power in the export trade has been enhanced to a degree not anticipated. In accordance with these favorable views people have been buying iron shares with considerable activity, and prices have been further advanced. Besides the advertisement for 700 locomotives mentioned in last week's letter, the railroad authorities are now advertising for contracts for 15,000 freight cars, to be completed and delivered by the end of September, 1913, and as this will involve a considerable demand for iron and steel, the news has had a good effect upon iron shares.

Belgian and French Advances

The upward movement in Belgium has been more pronounced within the past week than hitherto. A week ago the Belgian Steel Works Union decided to mark up semi-finished material 5 francs for the home trade, making the following new prices: Ingots, 116 francs; blooms, 122.50; billets, 131; and slabs, 133.50. Immediately following upon these advances the export price of bars was raised—iron bars 2 shillings, and basic steel bars 1 shilling per ton. It is added that this brings bar prices nearly up to the highest level reached last spring. The upward movement also continues in French Lorraine, where wire rods have just been marked up to 210 francs, a rise of 10 francs.

Buffalo

BUFFALO, N. Y., September 11, 1912.

Pig Iron.—Some producing interests report that sales were not so heavy this week and the market is somewhat quieter; others report the volume of demand to be fully as great as for some time past. The larger buyers have apparently covered for their principal requirements for some time to come, but there is a continued heavy run of smaller orders at the present scale of advanced prices, to which the furnaces are rigidly adhering. The aggregate of placement for the week amounts to probably 25,000 tons of all grades, largely for first quarter delivery, with about 10,000 to 12,000 tons under negotiation. Furnacemen would welcome an easing up in the demand, as the present volume is more than sufficient to absorb all of the iron they have to sell and their attention now being chiefly devoted to the producing of iron as rapidly as is necessary to keep pace with specifications and fill shipping directions which are simply overwhelming. Premium prices are very easily obtainable for deliveries over the remainder of the year; but very little iron is available for this purpose. Furnacemen are not seeking business

and are very lukewarm as regards contracting very far into next year. The ruling price for No. 1 foundry is $15.75 f.o.b. Buffalo and $15.25 to $15.50 for No. 2 X, depending somewhat upon the silicon content, and one interest announces $15.25 as the minimum for any grade, even for No. 3 and gray forge. The marked scarcity of semi-finished steel will undoubtedly operate in the near future to reduce the output of foundry iron in this district on account of furnace capacity of one interest being shifted from the latter to the former at as rapid a rate as possible. For remainder of year and first quarter and half of 1913 delivery, we quote as follows, f.o.b. Buffalo:

No. 1 foundry	$15.50 to $15.75
No. 2 X foundry	15.25 to 15.50
No. 2 plain	15.00 to 15.25
No. 3 foundry	15.00 to 15.25
Gray forge	15.00 to 15.25
Malleable	15.50 to 15.75
Basic	15.25 to 15.50
*Charcoal, according to brand and analysis	16.50 to 18.00

*For some of the higher grades and analysis $20 is asked.

Finished Iron and Steel.—The flood of incoming business is unabated; prices are more rigid and deliveries more extended. Many consumers are specifying two and three months ahead and in some cases the entire tonnage of contracts is fully specified for shipment during their life. Premiums are freely offered for stock shipments, but the larger mills are adhering strictly to their policy of not accepting premium business. One interest reports it is making bar contracts only with its regular patrons, mill output being fully taken up in caring for such trade. Consumers not regular customers are not served for wants not filled by their regular source of supply except through warehouse. The scarcity of semi-finished steel is an important feature which will probably cause a further rise in the price of finished materials shortly. Business in black and galvanized sheets has been of very good volume at full prices. The advance reported on tin plate is being strictly followed by all agencies, and mills are declining to accept 1913 business even at the advance. In plain structural and plates some interests are making contracts for specific work only, no general tonnage contracts being taken. In fabricated structural lines a large amount of work is being figured, but principally for jobs requiring only small tonnages. The Seneca Engineering Company, Ithaca, is low bidder on the 750 tons of steel for the new Ithaca high school building. The American Bridge Company received the contract for the steel, 50 tons, for the central heating plant for Cornell University. The Utica Steam Engine & Boiler Works has received a contract for steel for the wholesale dry goods building to be erected by Rathbun & Co., Utica, 150 tons, and the Syracuse Bridge Company has received a contract for the steel for the Cahill office building, Syracuse, 120 tons.

Old Material.—Local demand has increased noticeably in the week, particularly in material for foundries. Inquiry from outside districts has also been of larger volume. Dealers are holding prices rigidly to the recent advances, except for heavy melting steel, in which considerable offerings in the last few days have tended to soften the price slightly. We quote as follows, per gross ton, f.o.b. Buffalo:

Heavy melting steel	$13.25 to $13.75
Low phosphorus steel	16.25 to 17.00
No. 1 railroad wrought	13.75 to 14.50
No. 1 railroad and machinery cast scrap	13.50 to 14.25
Old steel axles	15.75 to 16.50
Old iron axles	22.50 to 23.00
Old car wheels	13.50 to 14.00
Railroad malleable	12.50 to 13.00
Boiler plate, sheared	14.25 to 14.75
Locomotive grate bars	11.25 to 11.50
Wrought pipe	9.75 to 10.25
Tank iron	10.25 to 10.50
Wrought iron and soft steel turnings	8.25 to 8.75
Clean cast borings	7.50 to 8.00

Boston

BOSTON, MASS., September 10, 1912.

Old Material.—The market is firm, with prices unchanged from last week. Material is coming out somewhat more freely, but the tendency is still to hold back for higher prices which producers anticipate for October. The quotations given below are of prices offered by the large dealers to the producers and to the smaller dealers and collectors, per gross ton, carload lots, f.o.b. Boston and other New England points, taking Boston rates from eastern Pennsylvania points. In comparison with Philadelphia prices the differential for freight of $2.30 a ton is included. Mill prices are approximately 50c. a ton more than dealers' prices:

Heavy melting steel	$11.75 to $12.00
Low phosphorus steel	13.50 to 14.00
Old steel axles	14.50 to 15.00
Old iron axles	22.00 to 22.50
Mixed shafting	13.50 to 14.00
No. 1 wrought and soft steel	11.50 to 11.75
Skeleton (bundled)	10.00 to 10.50
Wrought iron pipe	10.00 to 10.25
Cotton ties (bundled)	10.00 to 10.25
No. 2 light	4.50 to 5.00
Wrought turnings	8.00 to 8.50
Cast borings	7.25 to 7.50
Machinery, cast	12.50 to 13.00
Malleable	10.00 to 10.50
Grate bars	7.75 to 8.00
Stove plate	8.50 to 9.00
Cast-iron car wheels	12.50 to 13.00

New York

NEW YORK, September 11, 1912.

Pig Iron.—Purchases of pig iron made through local offices in the past two weeks reached a large total. The activity, while quite well maintained to the end of last week, now shows some signs of slackening. Large consumers have been prominent in the movement. Their purchases have for the most part been for 1913, first quarter delivery, and, in fewer cases, first half. The buying of the past six weeks has been marked by deliberation and orderliness, there being at no time the excitement which on other occasions has pushed up the price of pig iron rapidly. The level reached in the sharp movement of the fall of 1909 is still a considerable distance ahead. The past week's business in New York offices has probably amounted to 25,000 to 30,000 tons. Buffalo furnaces have made sales at $15 to $15.25 for No. 2 X for next year's delivery and in some cases where lower quotations were left open $15 was shaded. One New Jersey melter has bought 1800 tons that was under inquiry last week. Variations appear in furnace quotations, but producers as a rule are quite firm in their views. The possibility of a lull after the recent active buying is a factor and there is little disposition to look for a rapid advance. Virginia iron for 1913 delivery was put up 25 cents this week by one producer, or to $14.25 at furnace for No. 2 X. A sale of basic iron from Buffalo for prompt shipment into Eastern Pennsylvania is reported at $15 at furnace, the freight being $1.75. Southern iron at the recent advance to $13 for No. 2 at Birmingham is considerably above the parity of Northern irons in Eastern markets. We quote as follows for Northern iron at tidewater: No. 1 foundry, $16.50 to $16.75; No. 2 X, $16 to $16.50; No. 2 plain, $15.75 to $16. Southern iron is quoted at $17.25 to $17.50 for No. 1 foundry and $16.75 to $17 for No. 2.

Structural Material.—The situation has not changed, nor is any change expected inside of two or three weeks. Deliveries are if anything more extended than ever and of course specifications against contracts which expire October 1 keep coming in at a high rate, with efforts on the part of the mills to prevent any such material going into stock. The expected inquiries for new apartment houses have not yet developed to any extent, but there are two or three, averaging perhaps 1000 tons, which have reached the active stage and more promise to appear before very long. It is probable that fabricators in general have three months' work in hand, and the striking feature is the strength of the market which leads to numerous advances being secured, as has been the case recently, for material which must be had for definite and compelling uses. Among recent awards may be included 2000 tons for the Mystic River bridge for the Boston Elevated to the American Bridge Company; 500 tons for terminal area work for the New York Central, to Lewis F. Shoemaker & Co., and 1600 tons for the Merchants National Bank Building, Boston, said to have been given to the New England Structural Company. Plain structural material is quoted at 1.56c., New York, and 2.05c. from store.

Steel Plates.—Local demand has diminished appreciably but Eastern mills are still well filled, particularly for wide plates. On smaller sizes it is probable that delivery can be made in a week's time, but for the larger sizes four to six weeks appear to be the time required, with a little longer period for universal plates. There is considerable talk of another price advance for the third quarter. Sheared plates are quoted at 1.56c., New York, and universal plates at 1.61c.

Iron and Steel Bars.—It is claimed that quite a number of contracts for steel bars for the first quarter of 1913 have been closed at 1.35c., Pittsburgh. The volume of recent business booked is reported unusually heavy, and deliveries cover a wide range depending on the shape and weight of bars, being from three or four weeks to as many as sixteen or eighteen weeks. One unusually large manufacturing company, in inquiring

for next year's necessities, received quotations from three large steel mills, each at 1.35c., Pittsburgh. Iron bars continue also to move in large volume and are if anything stronger in price, the advance by one large producer to 1.45c., base New York, in carloads, not noticeably stopping the flow of orders. Last week's quotations are repeated as follows: Steel bars, 1.46c. to 1.51c., New York, and from store, 1.90c.; iron bars, 1.40c. to 1.50c., New York, and from store, 1.80c.

Cast Iron Pipe.—While inquiries are improving among general buyers, the volume of current business has not been heavy. As far as can be ascertained, no contracts have yet been placed for delivery next year, although more interest is shown in regard to prices for such shipment. Public lettings continue few and far apart. Carload lots of 6 in. are quotable at $22.50 to $23.50 per net ton, tidewater.

Old Material.—With no special feature, the volume of business the past week has been somewhat better than in immediately preceding weeks. The demand is of a general character, all kinds of material finding a somewhat ready market with the exception of cast scrap. The foundries are either using more pig iron than usual in their melt or their operations are quite light. No large transactions are reported in any grade of scrap. Prices are firm but unchanged. It is quite confidently expected that, after the railroad lists have been allotted, the demand from large consumers will flow toward the dealers and that prices will be higher. Dealers' quotations, per gross ton, New York and vicinity, are as follows:

Old girder and T rails for melting	$12.00 to $12.50
Heavy melting steel scrap	12.00 to 12.50
Relaying rails	21.50 to 22.00
Rerolling rails	14.00 to 14.50
Iron car axles	21.00 to 22.00
Old steel car axles	15.50 to 15.75
No. 1 railroad wrought	13.75 to 14.25
Wrought iron track scrap	13.00 to 13.50
No. 1 yard wrought, long	12.50 to 13.00
No. 1 yard wrought, short	11.75 to 12.25
Light iron	5.25 to 5.50
Cast borings	7.50 to 7.75
Wrought turnings	8.75 to 9.00
Wrought pipe	11.50 to 12.00
Old car wheels	13.25 to 13.75
No. 1 heavy cast, broken up	11.50 to 12.00
Stove plate	9.00 to 9.25
Locomotive grate bars	9.00 to 9.25
Malleable cast	10.00 to 10.50

Ferroalloys.—With higher prices the situation in ferromanganese is made more interesting by reason of advices from one or two English manufacturers that they have no 80 per cent. to sell at present. At the same time the present movement of ferromanganese into this country is freer than it has been for some time, but that arriving is being shipped against old contracts. For forward deliveriy $56.50, Baltimore, is being asked, and some business has been done on that basis. Some ferromanganese for early delivery was sold this week at $58.50. There is some inquiry for spot in carload lots, and one seller is quoting $65, though with no takers, and the price to draw business would have to be nearer $60. Ferrosilicon, 50 per cent., is unchanged at $72.50 for carload lots and ranging down to $70 for larger quantities. There has been some inquiry for next year's delivery.

Further Price Advances in England

Pig Iron and Semi-Finished Steel Strong and Active—American Prices Regarded Too High

(By Cable.)

MIDDLESBROUGH, ENGLAND, September 11, 1912.

The buoyancy in pig iron remains unimpaired. Makers are allowing large business to pass, being unwilling to sell much, as they anticipate higher prices. Buyers are showing an increased desire to contract far ahead. Stocks of pig iron in Connals stores are 283,906 tons, against 287,415 tons last week. Semi-finished material is strong and active. The German Steel Works Union has sold heavily of 2-in. billets at 102s. 6d. Americans seem to be asking too high prices. Demand for tin plates is better and the market is much firmer. Heavy business is being done in ferromanganese for over the whole of 1913 for America. September shipments have sold at $56.50, c.i.f. Baltimore, and the price, it is expected, will advance any day.

Cleveland pig iron warrants (closing Tuesday), 65s. 5½d. against 64s. 2½d. one week ago.

No. 3 Cleveland pig iron, maker's price, f.o.b. Middlesbrough, 65s. 9d., against 64s. 9d. one week ago and 63s. 3d. two weeks ago.

Steel sheet bars (Welsh) delivered at works in Swansea Valley £5 15s. for 1913 delivery.

German 2-in. billets, f.o.b. Antwerp, 102s. 6d.

German basic steel bars, f.o.b. Antwerp, £6 2s., an advance of 2s. from last week.

Steel bars, export, f.o.b. Clyde, £7 15s. to £7 17s. 6d.

Steel joists, 15-in., export, f.o.b. Hull or Grimsby, £7 5s.

Steel ship plates, Scotch, delivered local yard, £8 2s. 6d.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £9 10s.

Steel rails, export, f.o.b. works port, £6 7s. 6d. to £6 10s.

Tin plates, cokes, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 15s. 1½d., against 14s. 7½d. one week ago.

Metal Market

NEW YORK, September 11, 1912.

The Week's Prices

Cents Per Pound for Early Delivery.

	Copper, New York.			Lead		Spelter	
Sept.	Lake.	Electrolytic.	Tin, New York.	New York.	St. Louis.	New York.	St. Louis.
5	17.75	17.62½	47.50	4.85	4.75	7.40	7.25
6	17.75	17.62½	47.60	4.85	4.75	7.40	7.25
7	17.75	17.62½	.....	4.85	4.75	7.40	7.25
9	17.75	17.62½	47.95	5.10	4.95	7.40	7.25
10	17.75	17.62½	48.20	5.10	4.95	7.40	7.25
11	17.75	17.62½	48.62½	5.10	4.95	7.45	7.30

The strength of copper is fully maintained, and buying is going on quietly but with caution. Tin is more active and higher. Lead has been advanced to approximately English prices. Spelter continues to advance. Antimony is unchanged but stronger.

New York

Copper.—There has been quiet buying of copper at prices approximating 17.75c., cash 30 days, for Lake, and 17.62½c., cash New York, for electrolytic. At the latter figure copper is not plentiful, but it can be readily sold at that price. Holders, however, are for the most part demanding a higher price than consumers are willing to pay. Consumers are watching the market closely and their position is that of having contracted heavily for copper but now can use more than they purchased, especially of October and November delivery. Where it has been made known that copper was for sale consumers have inquired with absolute eagerness as to the terms on which they could obtain the metal, not only Lake but electrolytic and casting as well. One party offering at 17.70c. cash received many offers providing he would accept 17.62½c. The statistics of the Copper Producers' Association are generally conceded to have given added strength to the situation. Spot copper is quoted in London to-day at £78 8s. 9d. and futures at £79 3s. 9d. The exports this month total 6118 tons.

Pig Tin.—There has been in the last week a decided improvement in the tin market. The demand is much better and consumers who were for some time not in evidence as buyers have returned to the market and are taking interest. There was a good demand for tin September 9 and likewise on September 10. Inquiries seemed to be more for September delivery, so far as consumers were concerned, while dealers were more keenly interested in futures with a view of replenishing their supplies. September 10 probably 300 tons of tin were sold. The activity began this week. The price quoted to-day is 48.62½c. London prices are high and there is talk of still further advances, although there is a feeling in some quarters that the situation is too strong to last. Spot tin was quoted in London to-day at £222 and futures at £219, which establishes a record for the latter. The arrivals of tin this month were 1900 tons and there is afloat 2225 tons.

Tin Plates.—The expected advance in tin plates, which already had been heralded by the action of two large independent mills, came September 10 when the leading interests and all others advanced the price to $3.60 for box base. The demand continues unabated and the mills cannot make prompt deliveries on new contracts, which has thrown much good business in the way of those large jobbing houses who were well stocked up, and who now have advanced their price 10 cents a box. The price of 100 lb. coke plates in New York is now $3.84.

Lead.—On September 9 the American Smelting & Refining Company advanced lead $5 per ton, making the third advance within a very few days. The price at New York is now 5.10c. and at St. Louis 4.95c. The higher price is an outcome of the higher quotations in

London. On September 10 the English price of lead jumped to £23 15s. and in the afternoon closed at £23 for soft Spanish lead, a price which has ruled since and which is equivalent to 5.02c., New York. It is evident that with the New York price at 4.85c. American lead could be sold at a profit in London. In view of the pronounced shortage of lead in England, shipments abroad would have been almost inevitable under the circumstances and a stringency in supplies might have resulted here. This is the most reasonable explanation to be had for the latest advance. It is peculiar that the sentiment in lead is almost unanimously bullish, so much so that it has been asked if the situation is not too strong to last. In England the scarcity is attributed by some to the recent shipping strike and others allege that producers are really holding back the metal.

Spelter.—Large quantities of spelter are being consumed and the price is stronger in response to the advancing tendency of several days. It is noticeable, however, that spelter can be obtained without difficulty if the buyers meet the price demanded. The St. Louis price is 7.30c. and New York 7.35c.

Antimony.—Prices of antimony are unchanged, but the market is pronounced very strong. Cookson's is quoted at 8.60c., Hallett's at 7.87½c. and Chinese and Hungarian brands at 7.75c.

Old Metals.—While the strength of the demand causes an upward tendency, dealers' selling quotations are so far unchanged, as follows:

	Cents per lb.
Copper, heavy and crucible	16.25 to 16.50
Copper, heavy and wire	16.00 to 16.25
Copper, light and bottoms	14.00 to 14.25
Brass, heavy	10.25 to 10.50
Brass, light	8.25 to 8.50
Heavy machine composition	13.00 to 13.25
Clean brass turnings	9.50 to 9.75
Composition turnings	12.00 to 12.50
Lead, heavy	4.40
Lead, tea	4.15
Zinc, scrap	5.50

Chicago

SEPTEMBER 10.—A decided advance in the price of spelter characterized the metal market during the past week, affecting materially the price of galvanized products. Higher prices were likewise the rule for lead and tin. In some quarters copper appeared less active, but prices continue to be firmly maintained. We quote as follows: Casting copper, 17.50c.; Lake, 17.87½c. to 18c., in carloads for prompt shipment; small lots, ¼c. to ⅜c. higher; pig tin, carloads, 48c.; small lots, 50c.; lead, desilverized, 4.80c. to 4.85c. for 50-ton lots; corroding, 5.05c. to 5.10c. for 50-ton lots; in carloads, 2½c. per 100 lb. higher; spelter, 7.10c. to 7.20c.; Cookson's antimony, 9c., and other grades, 8.50c. in small lots; sheet zinc is $8.75 f.o.b. La Salle or Peru, Ill., less 8 per cent. discount in carloads of 600-lb. casks. On old metals we quote buying prices for less than carload lots: Copper wire, crucible shapes, 14.75c.; copper bottoms, 13c.; copper clips, 14c.; red brass, 12c.; yellow brass, 9.25c.; lead pipe, 4c.; zinc, 5c.; pewter, No. 1, 28.50c.; tinfoil, 33c.; block tin pipe, 40c.

St. Louis

SEPTEMBER 9.—There has been an advancing tendency in the metal markets during the week and spelter especially has scored a sharp rise. The quotations today stand as follows: Lead, 4.80c.; spelter, 7.25c.; tin, 48.25c. to 48.55c.; Lake copper, 18.10c. to 18.22½c.; electrolytic copper, 18c. to 18.12½c.; Cookson's antimony, 8.80c. In the Joplin ore district there was a sharp advance in zinc blende of $2.50 per ton, sending the basis price up to $58.50 for 60 per cent, while the range for less desirable grades was down to $54. For extra choice lots running above 60 per cent as high as $61 was paid. Little surplus ore was left in the bins. Calamine, 40 per cent, brought $29 to $31, while the choicer grades sold up to $37. Lead ore was in strong demand at $61 for 80 per cent and choicer lots brought more. The aggregate value of all ores sold for the district, $469,792, breaks all records for one week. On miscellaneous scrap we quote as follows: Light brass, 5.50c.; heavy brass and light copper, 9.50; heavy copper and copper wire, 10.50c.; pewter, 21c.; tinfoil, 31c. zinc, 3.50c.; lead, 3.50c.; tea lead, 3c.

Iron and Industrial Stocks

NEW YORK, September 11, 1912.

The stock market continues quiet, even the exuberant crop reports having failed to act as a stimulant to speculative activity. Here and there some stock has had a slight upward movement, but the general list has been decidedly sluggish. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week was as follows:

Bald. Loco., com...	58½- 59½	Pressed Steel, com..	36¾- 37½
Bald. Loco., pref...	106 -106½	Pressed Steel, pref.	102¼-102½
Beth. Steel, com...	39 - 40⅞	Railway Spring, com.	37⅛- 37¾
Beth. Steel, pref...	71¾- 73	Republic, com.....	26⅝- 27⅛
Can, com.....	38⅝- 40½	Republic, pref.....	87½- 89½
Can, pref.....	118 -120¾	Sloss, com.....	54½- 55
Car & Fdry., com..	60⅛- 61¼	Pipe, com.....	19¾- 20½
Car & Fdry., pref...	119⅞	Pipe, pref.....	59½
Steel Foundries ...	37 - 37¾	U. S. Steel, com....	72¼- 73⅝
Colorado Fuel	32½- 35½	U. S. Steel, pref....	112¾-113⅛
General Electric....	181½-182¼	Westinghouse Elec..	86¾- 89
Gr. N. Ore Cert...	45½- 46¾	Va. I. C. & Coke...	61 - 65
Int. Harv., com....	121 -126⅞	Am. Ship, com.....	46½- 49
Int. Pump, com....	26½- 26⅞	Am. Ship, pref.....	102
Int. Pump, pref.....	81	Chic. Pneu. Tool...	52½- 53
Lackawanna Steel...	43 - 44¾	Cambria Steel	47¼- 48¼
Locomotive, com....	43¾- 44¾	Lake Sup. Corp....	34⅛- 35¼
Locomotive, pref.....	109¼	Pa. Steel, pref.....	99
Nat. En. & St., com.	17 - 17½	Crucible Steel, com.	17⅛- 18¼
Nat. En. & St., pref.	90 - 92	Crucible Steel, pref.	96¾- 97
Pittsburgh Steel, pref.....	102¼		

Dividends Declared

The American Can Company, regular quarterly, 1¼ per cent. on the preferred stock, payable October 1.

The International Harvester Company, regular quarterly, 1¼ per cent. on the common stock, payable October 15.

The American Car & Foundry Company, regular quarterly, ½ of 1 per cent. on the common and 1¾ per cent. on the preferred stock, payable October 1.

The Lanston Monotype Machine Company, regular quarterly, 1½ per cent., payable September 30.

The J. I. Case Threshing Machine Company, regular quarterly, 1¾ per cent., payable October 1.

The Cambria Iron Company (underlying company), regular semi-annual, 2 per cent., payable October 1.

Personal

A. F. Huston, president Lukens Iron & Steel Company, Coatesville, Pa., has returned from a six months' vacation, during which time he toured New England and New York, and spent about a month at his summer home near Boston.

Frank H. Gordon has been appointed general manager of sales for the Lukens Iron & Steel Company, Coatesville, Pa., succeeding J. R. Van Ormer, who has relinquished that position because of ill health, but still remains with the company.

W. Schwanhausser, New York, chief engineer of the International Steam Pump Company, has returned from a business trip to Europe.

Norman B. Roper, formerly of the Cerro Pasco Mining Company, Peru, now with Backus & Johnson Company of Casapalco, Peru, is visiting in the United States.

Charles S. Price, president of the Cambria Steel Company, Johnstown, Pa., who is taking a vacation on account of ill health, is reported as much improved. He expects to resume his duties with the company in the near future.

G. S. Ginrich, advertising manager Cincinnati Milling Machine Company, Oakley, Ohio, has returned from a several months' business trip to Europe.

John M. Howett, formerly in the iron and steel business in Cincinnati, Ohio, has been appointed manager of the Cincinnati office of the Pratt & Whitney Company, Hartford, Conn., with office and salesroom at 336 West Fourth avenue.

B. A. Wallingford, of Walter-Wallingford & Co., Cincinnati pig iron merchants, is absent on a vacation trip to the Pacific coast.

Elmer Erickson has been appointed purchasing agent for the Chicago Junction Railway Company and the Union Stock Yard & Transit Company, with office at 1305 First National Bank Building, Chicago.

W. Frank Roberts, who has been assistant superintendent of the Bethlehem Steel Company, South Bethlehem, Pa., has been made superintendent of the Lehigh works of the company.

Louis Wilputte, formerly manager of the American branch of the H. Koppers Company, has been elected vice-president of the United Coke & Gas Company, 17 Battery

place, New York, which represents the Otto-Hoffman coke oven in the United States.

Robert M. Wells, who for many years was associated with the Wells & Nellegar Hardware Company, and is now treasurer of the Fidelity Brass Mfg. Company, 730-734 West Monroe street, Chicago, is "back to the desk" during the absence of his son Bradford, president of the latter company, who is taking his vacation in Northern Ontario.

H. J. Onions, superintendent of the Gisholt Machine Company's plant at Warren, Pa., where small sizes of boring mills are manufactured, recently spent a week calling on trade friends in the East.

H. Sanborn Smith, general manager of sales of the Southern Iron & Steel Company, has been in England recently in the interest of his company, which has for some time been a seller of billets to mills in England and Scotland.

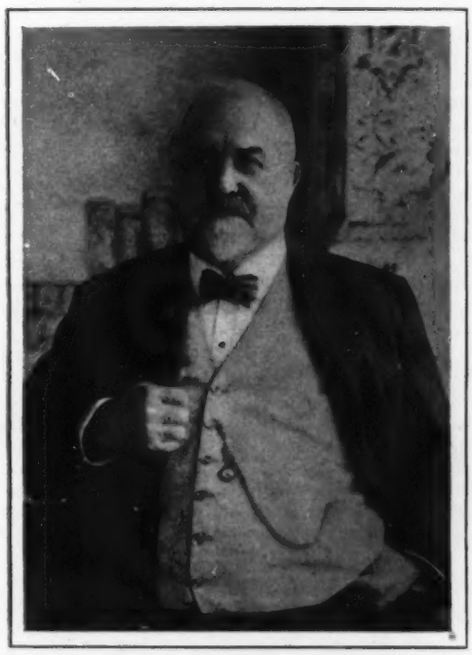
Joseph Farrell, president Mackintosh, Hemphill & Co., Pittsburgh, will sail for Europe September 19 on a pleasure trip, to be gone about three months. He will make an automobile tour of England and France.

Willis L. King, vice-president Jones & Laughlin Steel Company, is chairman of the Committee of Arrangements for the meeting of the American Iron and Steel Institute in Pittsburgh, October 25 and 26. Other members are A. C. Dinkey, president Carnegie Steel Company; W. B. Schiller, president National Tube Company; J. G. Butler, Jr., vice-president Brier Hill Steel Company; and J. A. Campbell, president Youngstown Sheet & Tube Company.

Obituary

George W. McClure

George W. McClure, founder of the firm of G. W. McClure, Son & Co., engineers and contractors, died at his home in Pittsburgh, September 4, aged 76 years. He was born in Pittsburgh, where he received his early education in the public schools. When 22 years of age he became a contractor. His first work in the blast furnace line was with Lyon & Shorb, this firm at that time also operating the Sligo plant in Pittsburgh, after which he



GEORGE W. MCCLURE

built blast furnaces for John H. Shoenberger and James Wood. Keeping himself posted in all improvements pertaining to the manufacture of iron and steel, Mr. McClure was largely instrumental in bringing into use a number of advanced methods in blast furnace construction as they came into vogue in this and other countries. His experience was especially extensive with methods of heating air for blast furnace practice. In 1883 he formed a partnership with A. Schuler, but the death of the latter caused the firm of McClure & Amsler to be formed in 1888. James W. McClure, his son, was taken into partnership on the death of Mr. Amsler in 1894, and in 1899 Joseph B. Pearson, for many years connected with the office, became a member. Married in 1859, his wife died six years ago. He leaves one son, James W. McClure, and two daughters.

Frederick J. Mayer

Frederick J. Mayer, general manager of the Didier-March Company, died September 1 at his home in New York City, aged 59 years. He was born at Bremerhaven, Germany, received his early education at the University of Stuttgart, and came to this country in 1870 after the Franco-Prussian war, in which he saw active service. Being an engineer, he engaged with the Bartlett-Hayward Company, Baltimore, Md., as draftsman, and, as chief engineer, he designed, erected and operated many of the large gas plants constructed by that company. In 1906 he severed that connection and organized and established the Didier-March Company in the United States taking the position of general manager.

Having made a life study of the carbonization of coal for metallurgical and domestic purposes, to Mr. Mayer must be credited the establishing of some of the best foreign apparatus in the United States for the carbonization of coal by both the intermittent and continuous system in vertical retorts for gas house practice. He not only secured these rights for the United States, but he promoted the companies, erected the plants and put them in successful operation. He was the inventor of many improvements for the manufacture of illuminating gas, patents for which were secured in the United States, Germany, France and England. He was an ardent and tireless worker, well known in the United States and abroad; a member of the American Gas Institute, the American Society of Mechanical Engineers, the Illuminating Engineering Society, Chemists' Club, American Peat Society, German Club, and many other social and technical organizations. He leaves a widow.

GEORGE E. DOWNE, Canton, Ohio, died September 4, aged 55 years. He was a native of Massachusetts, and in his early life was connected with the saw industry, but about 30 years ago became identified with the introduction of the Spence hot-water heater for house heating into the United States, having been one of the original officers of the National Hot-Water Heater Company, of Boston. Largely through his initiative in connection with other manufacturers, the American Boiler Company, of which he was for a time the vice-president and general manager, was formed. Later he established the Ideal Boiler Company and sold his interests to the American Radiator Company, and for a number of years was manager of the boiler department of that company, during which time he exerted an influence in the establishment of the boiler business of the company on a firm basis. He traveled throughout the entire United States and also visited a number of European countries. Later he retired from this company to become an officer and take the management of the J. H. McLain Company, Canton.

HENRY F. DONALDSON, president of the Society of Automobile Engineers, New York, died August 15, aged 45 years. He was born in Dublin, Ireland, received a collegiate training and was connected for six years in an engineering capacity with Harland & Wolff, ship builders, Belfast. Coming to America in 1887, he engaged in journalistic work on daily papers in New York and then in Chicago. In 1897 he became editor of Marine Engineering and subsequently of the Automobile. Recognizing the fundamentally economic importance of motor truck haulage, he was the first editor of the Commercial Vehicle, in which capacity he continued until he established an office in New York City as consulting automobile engineer. He was elected president of the Society of Automobile Engineers in January, 1912. He leaves a widow.

WILLIAM H. GALLISON, Boston, Mass., president of the iron and steel house of the William H. Gallison Company of that city, died September 5, aged 76 years, A native of Marblehead, Mass., Mr. Gallison went West as a young

man, but after a few years in Cincinnati and Dayton, Ohio, returned to Massachusetts, and associated himself with Hill, Clarke & Co., machinery dealers. In 1878 he established the business which has borne his name ever since. He leaves a widow and two daughters.

F. R. CROTHERS, president of the Crothers Plow Works, Coulterville, Ill., died September 2, aged 83 years. He was born in Indianapolis, but moved to Illinois in 1838 and established the plow works in 1843. The first steel plow manufactured in Illinois is said to have been made in his works in 1860. He leaves a wife and two daughters.

ANTHONY SCHNIER, president of the Smith, Meyer & Schnier Company, Cincinnati, Ohio, died at his residence in that city September 6, aged 81 years. He had been conducting a machinery repair and specialty shop in Cincinnati for nearly 50 years.

BENJAMIN NICHOLS, president of the Nichols Iron Works, Jamestown, N. Y., died September 6, at his summer home at Thousand Island Park, aged 70 years. He was one of the pioneers in the establishment of Jamestown's industries.

HAROLD G. WILSON, Detroit, Mich., secretary and general manager of the Pittsburgh Steel Shafting Company of Detroit, died suddenly September 2, aged 30 years. He leaves a widow.

CHARLES E. RICHARDS, senior member of the textile machinery firm of Richards, Atkinson & Haserick, Boston, Mass., died recently in England. He was the English representative of the house, and made his home in Bradford.

Pittsburgh and Vicinity Business Notes

Albert F. Plock, engineer, Park Building, Pittsburgh, is preparing plans for three hot blast stoves to be built by the Bon Air Coal & Iron Company at Allen's Creek, Tenn. The stoves will be of the Whitwell three-pass improved type.

The report from Middletown, Ohio, that the Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., will build a branch works at Middletown is officially denied.

The report current in Pittsburgh last week that the American Sheet & Tin Plate Company is negotiating for the purchase of the plant of the McKeesport Tin Plate Company is officially denied by both companies.

The South Fork Foundry Company, Johnstown, Pa., has placed orders for the electrification of its entire plant. Individual motors will be installed for operating all machinery, and power supply and equipment has been contracted for. A new department is to be added to the plant in the near future, plans for which are now under way.

The Petroleum Iron Works Company, Sharon, Pa., builder of heavy plate work, has re-elected the following directors: H. C. Knowles, C. H. Todd, P. J. Sweeney, C. J. McDowell, J. L. Considine, all of Sharon; John Slater, Washington, Pa., and J. S. Cullinan, Houston, Tex. The directors re-elected the following officers: C. H. Todd, president; John L. Considine, vice-president; P. J. Sweeney, secretary and treasurer; H. C. Knowles, assistant secretary and treasurer.

The Pennsylvania Tank Car Company, Sharon, Pa., has re-elected C. H. Todd, J. L. Considine and John Slater directors. E. F. Wood Smith was re-elected president and P. J. Sweeney secretary and treasurer.

The J. & J. B. Milholland Company, Pittsburgh, will furnish all the operating machinery and valves for the new lock at St. Mary Falls, Sault Ste. Marie, Mich. The contract includes four electrically-driven capstans, eight electrically-driven operating machines and 12 air engines for operating the filling valves. The company has also received a contract for steel castings for mitering lock gates on the Mississippi River and sluice gates for locks B and C on the Cumberland River, Tennessee.

The Standard Sheet Metal Mfg. Company, now located in Pittsburgh, has nearly finished the building of a new plant at Washington, Pa. The main building is of reinforced concrete construction, 80 x 180 ft., one and two stories. The company manufactures pressed steel window frames, sash and skylights, and was recently reorganized, the capital being increased to $50,000. Presses and other machinery are being shipped from the works in Pittsburgh to the new plant, and a good deal of new equipment will be bought. Electric power will be used, group and individual drive being utilized. F. J. McCaskey is president and J. S. Forsythe, secretary and treasurer. The new plant will be ready for operation about October 1.

The American Vanadium Company has let the contract for the erection of its new plant at Bridgeville, near Pittsburgh, to the C. H. Kerr Company of Pittsburgh, and the estimated cost is $350,000. The plans were drawn by Samuel Diescher & Sons, Farmers' Bank Building, Pittsburgh. There will be a storage building, furnace building, crusher building, machine shop, store house, reduction building and office building.

The Pittsburgh Foundrymen's Association

The first of the 1912-13 meetings of the Pittsburgh Foundrymen's Association was held in the Fort Pitt Hotel on the evening of September 9, having been preceded by a dinner. W. A. Bole presided and F. H. Zimmers was secretary. The chair announced a programme committee for 1912-13, consisting of H. W. Petty, American Steel Foundries; E. D. Frohman, S. Obermayer Company; C. H. Gale, Pennsylvania Malleable Company, all of Pittsburgh. The Hill & Griffith Company of Cincinnati, James A. Carey resident manager, Pittsburgh, was elected to membership.

Dr. Richard Moldenke, secretary American Foundrymen's Association, explained the plans made for the convention to be held in Buffalo September 24 to 26, and stated that a list of papers had been arranged that would insure interesting sessions. J. S. McCormick, J. S. McCormick Company, stated that indications were that the exhibits at Buffalo in charge of the Foundry & Machine Exhibition Company promise to be fully as large as those at the Pittsburgh convention last year, and probably would be greater. It is expected that from 30 to 35 foundry concerns of Pittsburgh will be represented at the convention.

W. O. Renkin, who was supervising engineer for the building of the plant of the Tata Iron & Steel Company at Sakchi, Bengal, India, gave an interesting talk on his experiences in employing native labor and described some of the customs of the various castes in India.

New Open Hearth Furnaces at Clairton

The United States Steel Corporation will add to the steel capacity of the Clairton, Pa., works by the erection of two 60-ton open hearth furnaces. For some time there has been a surplus of finishing capacity at Clairton and the new construction just authorized will bring the plant in balance.

George C. Kimball, Hartford, Conn., was appointed by the Superior Court, September 10, temporary receiver of the Pratt & Cady Company. The appointment was made on the application of the directors of the company to prevent the tying up of the merchandise or plant by hostile or anxious creditors. A statement of the company's affairs has not as yet been made public, but the directors assert that its assets are in excess of its liabilities. The volume of orders in hand is large, and it is believed that the embarrassment will only be temporary. The company is a manufacturer of valves, making several thousand kinds and sizes. It employs between 400 and 500 men. George W. Hayden is president and E. L. King is secretary and treasurer.

Customs Decision

Wire Tea Strainers

F. W. Woolworth & Co. have had their protest sustained before the Board of United States General Appraisers in regard to an importation of tea strainers made of wire, metal and wood. Duty had been assessed under paragraph 199 as "articles of metal not specially provided for" and the merchandise was claimed to be properly dutiable as "articles in chief value of wire." An examination of the goods showed that the iron or steel wire used in the mesh was smaller than No. 16 gauge, was coated with tin, and should therefore be assessed at 40 per cent. under the dragnet clause of wire, paragraph 135.

American Locomotive Company

Gross Earnings Declined $10,199,933.45

The American Locomotive Company's eleventh annual report, covering the fiscal year ended June 30, 1912, makes an unfavorable showing as compared with the previous year. Gross earnings diminished $10,199,333.45 and the surplus, after allowing for depreciation and the full preferred dividend, was only $117,554.21, or $1,698,007.55 less than the surplus at the close of the preceding year. The condensed income account (including the Montreal Locomotive Works, Ltd.) for the two years is as follows:

Condensed Income Account

	1911-12.	1910-11.	Decreases.
Gross earnings	$30,449,451.63	$40,649,385.08	$10,199,933.45
Manufacturing, maintenance, and administrative expenses and depreciation	28,117,547.15	36,526,514.79	8,408,967.64
Net earnings	$2,331,904.48	$4,122,870.29	$1,790,965.81
Interest, etc., on bonds of constituent companies, coupon notes, etc.	464,350.27	557,308.53	92,958.26
Profit	$1,867,554.21	$3,565,561.76	$1,698,007.55
Dividends on preferred stock at 7 per cent.	1,750,000.00	1,750,000.00	.....
Surplus	$117,554.21	$1,815,561.76	$1,698,007.55
Extraordinary additions and betterment fund	.....	300,000.00	300,000.00
Net credit to profit and loss	$117,554.21	$1,515,561.76	$1,398.007.55

The combined general balance sheet, as of June 30, 1912, is as follows:

Assets

Cost of property		$53,019,951.93
Securities owned:		
Richmond Locomotive & Machine Works Consolidated mortgage bonds	$118,000.00	
Sundry securities	750,223.48	868,223.48
Convertible assets:		
Cash	$4,375,540.39	
Accounts collectible	9,924,566.22	
Bills receivable	777,592.44	
Accrued interest	13,123.38	
Material and supplies	5,688,823.44	
Contract work in course of construction	2,051,187.38	
Steam shovels, industrial locomotives and automobiles, manufactured for stock	952,620.96	
		23,783,454.21
Sundry deferred charges		286,277.29
Notes discounted (per contra)		1,529,567.58
Total		$79,487,474.49

Liabilities

Preferred stock	$25,000,000.00	
Common stock	25,000,000.00	$50,000,000.00
Bonded debt of constituent companies:		
Richmond Locomotive Works	$550,000.00	
Rogers Locomotive Works	255,000.00	
Montreal Locomotive Works	1,500,000.00	2,305,000.00
Current liabilities:		
Notes of Oct. 1, 1909	$5,000,000.00	
Notes of July 1, 1912	3,600,000.00	
	$8,600,000.00	
Loans payable	1,500,000.00	
Accounts payable	4,503,232.52	
Accrued interest	92,876.03	
Unclaimed interest	450.00	
Dividends preferred stock payable July 21, 1912	437,500.00	15,134,058.55
Endorsements (per contra)		1,529,567.58
Depreciation reserve, etc.		428,600.16
Extraordinary additions and betterment fund		416,022.82
Profit and loss:		
Balance June 30, 1911	$9,556,671.17	
Add profit as shown in income account	117,554.21	9,674,225.38
Total		$79,487,474.49

The President's Remarks

From the accompanying remarks by President W. H. Marshall the following extracts are taken:

"The volume of sales for the first half of the fiscal year was at a low ebb, and was equivalent to only 33 per cent. of the amount of business necessary to keep the plants running at full capacity. Since January 1 there has been a much stronger demand for new locomotives with the gratifying result that the amount of unfilled orders on the books on July 1 was $14,450,000, as compared with $6,015,000 at the beginning of the year.

"Apart from the loss in profits due to the natural decrease in business, the company suffered serious financial loss as a result of a strike of its boilermakers which affected practically all of its plants and lasted from October, 1911, to February, 1912. During this period production was badly retarded, and at times the plants were practically at a standstill.

"Solely out of sympathy with the boilermakers of a railroad system who were out on a strike, our boilermakers insisted that this company should not perform its contracts with the railroad until the railroad had adjusted its differences with its own boilermakers. This company could not, as a matter of principle, submit to such a demand, and stood firm in its position until our workmen receded from the attitude they had taken.

"There was expended during the year for additions and betterments on the plants the sum of $436,735.50, of which $267,350.21 was charged to capital account and the remainder to the 'extraordinary additions and betterment fund,' leaving a balance in that fund of $416,022.82. On October 1, 1912, there will be paid the first instalment of $1,000,000 of short term gold coupon notes which were issued October 1, 1909."

"The bonds of the Dickson Mfg. Company, amounting to $562,500, heretofore carried as a liability, were retired during the year and therefore are not shown on the subjoined balance sheet.

"During the year the company discontinued the manufacture of steam shovels and dredges and made a contract with the Bucyrus Company by which that company purchased all new steam shovels and steam shovel parts and materials which were in stock on January 1, 1912. The Rogers Works, at which plant this class of product was made, will continue to manufacture small locomotives for logging, plantation and contractors' use.

"The Atlantic Equipment Company, the entire capital stock of which is owned by this company, has for a number of years negotiated the sale of steam shovels, dredges, industrial locomotives and second-hand railroad equipment. The manufacture of steam shovels and dredges having been discontinued, the Atlantic Equipment Company has disposed of its business in second-hand equipment and all sales of industrial locomotives will be made by the American Locomotive Company."

Raising the Maine

A well illustrated 40-page brochure known as bulletin No. 102 has been issued by the Lackawanna Steel Company. It describes completely the work of raising the wreck of the United States battleship Maine from the bottom of Havana Harbor, from the time it sunk on the evening of February 15, 1898, to the time it was buried at sea off the Cuban coast on March 16, 1912. A short illustrated description of the raising of this vessel appeared in *The Iron Age* of June 8, 1911. Briefly the plan followed was to construct a cofferdam composed of cylinders of Lackawanna sheet steel piling, fill them with sand dug out of the harbor and then pump the inclosed space dry. In all some 4762 tons of piling in lengths of 25, 35, 40 and 50 ft. was used. After the vessel was removed, the cofferdam was taken away. The construction of the dam is described in detail, and the text is supplemented by numerous halftone engravings and line drawings which show graphically how the work was done. The first load of piling was delivered six weeks after the receipt of the contract and the entire quantity was completely driven in 110 days. The piling which has been removed from the cofferdam is in good condition and most of it is fit for service in other work.

The meetings of the Cleveland Engineering Society, Cleveland, Ohio, which were suspended during the summer were resumed September 10. Building codes was the subject for discussion.

The annual convention of the National Implement & Vehicle Association of the United States will be held at the Hotel Statler, Cleveland, Ohio, October 23, 24 and 25.

American Research Work on Rails*

Some Results of Investigations Which Have Been Conducted Jointly by Railroads and Steel Manufacturers

BY M. H. WICKHORST, CHICAGO

Several years ago the number of rails in the United States that failed to give normal service or that broke under moving trains became alarmingly large. The worst condition was reached about 1905. The circumstances so agitated the executive officers of the railroads that the matter was made the subject of an investigation by the American Railway Association, an organization of railroads dealing with matters of railroad operation of common interest.

Reliable general statistics are not available to show numerically the exact condition as regards rail failures, but an idea may be obtained from the report of one road that, of a lot of 10,000 tons rolled and put in the track, 22 per cent. were removed in the first year on account of depressions in the head. When broken apart the majority of these rails showed interior openings in the head running lengthwise of the rail. Happily that extreme state of affairs has passed.

Railroad Conditions

The wheel loads of the rolling equipment, locomotives, passenger cars and freight cars had been rapidly increasing for 20 years or more. H. V. Wille has shown that the average total weight on drivers increased from about 69,000 lb. in 1885 to over 180,000 lb. in 1907, and reached a maximum of 316,000 lb. in that year. The average axle load increased from 22,000 lb. in 1885 to 48,000 lb. in 1907. Since then the axle loads have still further increased.

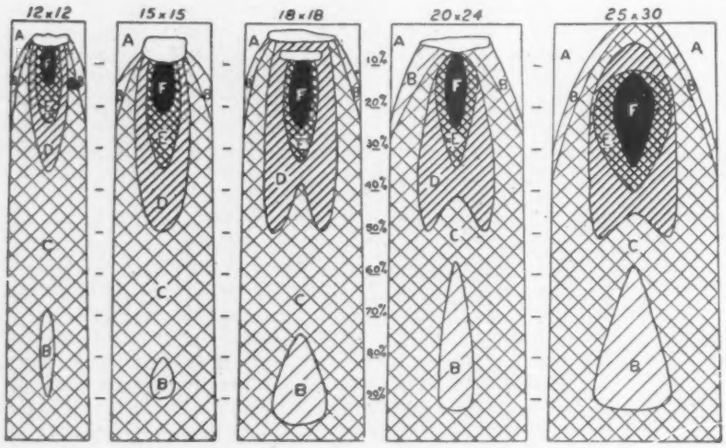


Fig. 1—Distribution of Phosphorous in Ingots of Different Sizes

During the same period the weight of rail (in main line track) increased from about 65 to 75 lb. per yd. to 85 to 100 lb. per yd., which are also now the prevailing weights. The moments of inertia increased from about 15 to 20 to about 30 to 45. At the time the American Society of Civil Engineers adopted standard sections in 1893, 80-lb. rails were just coming into use. Considered as a girder, the strength of the rail increased about at the same rate as the axle load increased, the unit stress in tension remaining about the same or even decreasing slightly. The unit stress in compression, however, increased almost as the axle load increased, as the average width of rail head increased only from about 2⅜ in. to about 2¾ in., and the diameter of the wheels has remained about the same.

Steel Mill Conditions

While the railroads were thus busy increasing the capacity of their motive power and cars, the steel mills were likewise endeavoring to obtained increased tonnage. These efforts took the form of eliminating unnecessary delays, installing larger converters and more powerful machinery, using larger ingots, and sometimes of allowing less time for the chemical reactions. At the hight of the tonnage endeavor in the rail mills, about five years ago, there was considerable rivalry between the different mills to produce the greatest tonnage, and it reached a condition that might almost be termed madness, that had only secondary regard for the quality of the product. The purchaser had the choice of buying rails as made by the mills or going without them. Recently, however, there has been a happy change, so that quality is being given due consideration and mutual consultations are taking place. The change was due, presumably, to the chastening effect of slack orders for rails and the present state of public opinion.

Investigation by the Railroads

In 1906 the American Railway Association took the matter in hand through its Committee on Standard Rail and Wheel Sections, which committee made a report in 1908 submitting some new designs for rail sections and also offering some tentative specifications. The matter was then referred to the American Railway Engineering and Maintenance of Way Association, now called (since April, 1911) the American Railway Engineering Association.

The prevailing type of failure seems to have been the split head, generally termed "piped rail." The rails developed internal cavities, mostly in the head, running lengthwise of the rail for distances of several feet or more. It seems to have been the prevalent opinion that this and other types of failure as well as poor wear were due partly to internal structural defects and partly to finishing the head of the rail at too high a temperature. It was argued that the flanges were too thin, cooling quickly in the rolling, and that a temperature necessary to finish the flanges properly left the temperature of the head unduly high.

The remedy suggested was to make the flanges thicker, thus allowing of more uniform finishing temperature throughout the section. W. R. Webster wrote in 1901 as follows: "The cause of the trouble is now well known, it being due to the large mass of metal in the head carrying the heat so much longer than the thin metal in the flanges, thus preventing the work of rolling on the head at sufficiently low temperature to break up the coarse grain and produce the tough, good wearing rails desired." The committee of the American Railway Association later shared this same view to a large extent, as evidenced by the fact that the main feature of the rail designs they presented was the greater thickness of the flanges.

Recent work, which will be referred to later on, indicates that from the standpoint of safety high temperature of rolling is not detrimental, and that few if any failures can be attributed to this cause. I am referring now to split-head failures in Bessemer rails, as this was the prevailing type of failure, and open-hearth steel had not yet come into extensive use. The recent work has also shown that such failures occur almost entirely in badly segregated metal from the top part of the ingot, attended perhaps with laminations and slag seams. Under pressure the top of the head of the rail spreads sideways, and as the interior of the head with such metal as referred to cannot likewise extend laterally it develops a crack, which grows until failure results. Of course, increase of pressure would hasten the development of such failures.

*Presented to the Sixth Congress of the International Association for Testing Materials, New York, September, 1912.

It has indeed been more or less definitely recognized that split heads occurred mostly in rail from the upper part of the ingot, but the blame was placed on internal structural defects. The trouble is now well known, it being traceable to the large mass due to blowholes and pipes in that part of the ingot; the rôle of segregation was but vaguely recognized. In Europe the part played by segregation had probably been more definitely worked out years before, but the results of that work seem to have been overlooked or at any rate their importance had not been fully appreciated in America.

Arrangement of Recent Work

As stated, the matter was turned over in 1908 to the American Railway Engineering Association to continue the work of investigation. This association appointed a committee, which continued the investigations started by the committee of the American Railway Association, and which also made a co-operative arrangement with the manufacturers of steel rails by which the latter furnish the material and facilities of their mills for research work, and the railroads furnish the engineer to conduct the tests under the direction of their committee and publish the results. The writer was honored by selection for the position of engineer of tests and entered upon his duties February 1, 1910. The full reports of the work done in 1910, together with other matter collected by the committee, are published in the Proceedings of the American Railway Engineering Association, 1911, Part 2, and it is expected that the reports of the work done in 1911 will appear in the Proceedings for 1912. Herewith are indicated some of the main results obtained, but those specially interested are referred to the above Proceedings for the full reports.

Segregation as Influenced by Size of Ingot

An investigation was made of ingots of Bessemer steel of various sizes from 12 x 12 in. to 25 x 30 in. at the bottom, all about 5 ft. high, weighing from 2000 to 10,000 lb. As part of the investigation, a chemical survey was made of these ingots to determine the distribution of the various elements, particularly as influenced by the size of the ingot.

The distribution of phosphorus in the various ingots is shown in Fig. 1. It may be said that carbon and sulphur show a similar distribution, differing, of course, as to the amounts in the various regions. The diagrams indicate that the regions of concentration of the phosphorus, figured as a percentage of the volume of the ingot, increase as the size of the ingot increases; the analyses also indicated that the maximum concentration of phosphorus in the segregated region increases as the size of the ingot increases.

The regions of negative segregation, that is, decrease of phosphorus below the average of the steel as poured, are also of considerable interest. The top of the ingot shows considerable decrease of the phosphorus, carbon and sulphur, and this decrease extends downward along the sides a greater distance in the larger ingots. The analyses also showed that the amount of the deficiency in phosphorus increased in a general way as the size of the ingot increased. This means that the outer parts of the section of a rail made from the upper end are softer than the average of the steel from that ingot, and this has been found true of rails examined by means of tensile tests. There is also a region of milder negative segregation in the interior and lower part of the ingot.

Ductility of Rails

A comparison of the ductility of rails made by the ordinary Bessemer process, as measured in the drop test and in the tension test, is interesting. Fig. 2 is given to show the comparison. The distance from the top of the ingot in per cent. of weight is plotted horizontally and the per cent. elongation is plotted vertically. The elongation in the tension test was measured on a testpiece ½ in. diameter with a gage length of 2 in. The elongation in the drop test was measured by placing gage marks near the middle of the length of the piece of rail on the side in tension, 1 in. apart, for a distance of 6 in., and the length of the space which stretched most when broken under the drop was taken as the measure of the ductility of the rail in the drop test. Two curves are given showing the ductility of the rail bar in the drop test, one with the head in tension and the other with the base in tension. Two other curves are given showing the ductility of the rail bar in the tension test, one representing the interior of the head near its junction with the web and one representing the average of the flange and the upper corner of the head, as the results from these two locations were about the same.

In the tension test the exterior metal (as represented by the flange and the corner of the head) shows good ductility along the whole rail bar, although there is a general increase as we go down the ingot, from about 14½ per cent. elongation at 10 per cent. from the top to about 18½ per cent. elongation at 90 per cent. down. The results from the interior of the head near the web, however, differ considerably from these. There is fair ductility near the top, the elongation then drops off to less than 5 per cent. at about 15 per cent. from the top, and it then rises again and in the lower part of the rail bar averages slightly above the results from the exterior of the section.

In the drop test with base in tension, the elongation runs from 12 per cent. to 24 per cent. With the head in tension there is also a continuous increase in going down the ingot, but the differences in elongation are much greater (8 per cent. to 27 per cent.). In this respect there is considerable similarity between the ductility measured in the tension test of samples from the interior of the head and the ductility as measured in the drop test with the head in tension. It would seem, therefore, that this latter test may be more useful to ascertain the ductility of the interior metal than the drop test with the base in tension, as is usual in inspection work. Since the above was first written the Railway Age Gazette (December 8, 1911, p. 1176) has abstracted an article by C. Frémont in Le Génie Civil, in which Frémont comes to about the same conclusion, but goes a little farther and recommends that some of the top of the head be first planed off and the rail then tested by the drop test with the head in tension.

Influence of Temperature of Rolling

An investigation was made to determine the influence of the temperature at which the steel is rolled on the properties of Bessemer rails. A series of five ingots from

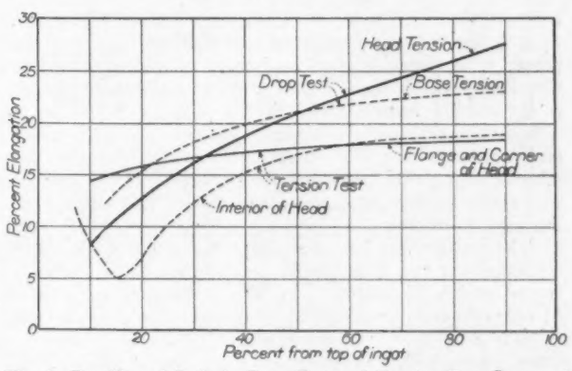


Fig. 2—Ductility of Rails in Drop Test and Tension Test Compared

one heat of Bessemer steel was rolled into rails, all in similar manner except as to the temperature at which they were rolled. One ingot was rolled "cold" and the temperature was increased with the succeeding ingots, finally rolling the last ingot very hot. The influence of the temperature as ascertained by these tests may be summed up as follows:

The ductility and deflection in the drop test were influenced little, if any, by the rolling temperature. The number of blows that it took to break the rails in the drop test was uninfluenced by the temperature of rolling. The yield point and tensile strength in the tension tests were influenced little, if any. The elongation in the tension test decreased some as the temperature increased. The influence of temperature showed most prominently, in the tension test, in the reduction of area, which decreased as the temperature of rolling increased. The size of the grain, as shown by the microscope, increased as the temperature increased.

Plan of Work

The general plan of our research work has been to direct attention to some one item which enters as a factor in the properties of the finished rail and attempt to obtain definite information concerning its influence by the ex-

perimental method of obtaining as great a range as practicable in the one item under consideration, but leaving all other conditions as near alike as possible. It is thus hoped to aid in establishing in the course of time the metallurgical principles and laws that apply to the manufacture of steel rails for the purpose of designing specifications and rail sections that will give uniformly safe rails of good wearing qualities, and at a minimum cost.

The condition of co-operation in this work existing between the railroads and steel manufacturers is very gratifying and may confidently be expected to work to the best interests of the public, the railroads and the steel mills.

Microscopic Substances in Iron and Steel

The Nomenclature Adopted by the Sixth Congress of the International Association for Testing Materials

Below is given the report of Committee 53 on "The Nomenclature of Microscopic Substances and Structures of Steel and Cast Iron" presented to the Sixth Congress of the International Association for Testing Materials in New York last week. It was prepared by the chairman, H. M. Howe, and the secretary, A. Sauveur, and was supported unanimously by the committee and adopted by the congress. In addition to Professor Howe and Professor Sauveur the committee was composed of the following: F. Osmond, Paris; Dr. H. C. H. Carpenter, Manchester; Prof. W. Campbell, New York; Prof. C. Benedicks, Stockholm; Prof. F. Wüst, Aachen; Prof. A. Stansfield, Montreal; Dr. J. E. Stead, Middlesbrough; Prof. L. Guillet, Paris; Prof. E. Heyn, Berlin-Lichterfelde; Dr. W. Rosenhain, Teddington, England. We give the report in full.

I. General Plan

We first enumerate the substances of such importance as to warrant it, indicating roughtly their constitution, and then define and describe certain of them.

The conditions which we meet are (1) that we need definitions on which all can agree; and this implies that they must be free from all contentious matter and be based on what all admit to be true. (2) That the reader must needs know the current theories as to the constitution of these substances, and these theories are necessarily contentious. We meet these conditions by the plan of giving (1) the Name which we recommend for general use, followed immediately in parentheses by the other names used widely enough to justify recording them; (2) the Definition proper, based on an undisputed quality, e. g. that of austenite which we base on its being an iron-carbon solid solution, purposely omitting all reference to the precise nature of solvent and solute; and (3) Constitution, etc., etc., in which we give the current theories as to the nature of solvent and solute and appropriate descriptive matter.

The distinction between these three parts should be understood. (1) The Names actually used are matter of record and indisputable. (2) The Definitions are matters of convention or treaty, binding on the contracting parties, though subject to denouncement, preferably based on some determinable property of the thing defined as distinguished from any theory as to its nature, or if necessarily based on any theory it should be a theory which is universally accepted. It is a matter purely of convention and general convenience what individual property of the thing defined shall form the basis of the definition. The name and the definition should endure permanently, except in the case of a definition based on an accepted theory, which must be changed if the theory should later be disproved. (3) Theories and Descriptions are not matters of agreement or convention, but dependent on observation, and therefore always subject to be changed by new discoveries. They are temporary in their nature, as distinguished from the names and definitions which should be fixed, at least relatively.

This case of austenite illustrate the advantage of non-indicative names. The names which we propose to displace, "gamma iron" and "mixed crystals," imply definite theories as to the nature of austenite, and hence might have to be abandoned in case those theories were later disproved. The name "austenite" implies nothing, like mineralogical names in general, and hence is stable in itself. Our infant branch of science may well learn from its elder sister, which has tried and proved the advantage of this non-indicative naming.

In those cases in which a name has been used in more than one sense we advise the retention of one and the abandonment of the others, having obtained the consent of the proposers of such names for their abandonment.

Many whose judgment we respect object to our including certain of the less used names, e. g. from i to u in our list, holding them either to be confusing or to be needless.

It is true that several names (hardenite, martensite, sorbite, etc.), have been used with various meanings, and hence confusingly, in spite of which most of them should be retained, each with a single sharp-cut definition, because they are so useful.

As regards the alleged needlessness of certain names, it is for each writer to decide whether he does or does not need names with nice shades of meaning, such as osmondite and troosto-sorbite. Those who look only at the general outlines and not at the details have no right to forbid the workers in detail from having and using words fitting their work; nor have those whose needs are satisfied by the three primary colors a right to forbid painters, dyers, weavers, and others from naming the many shades with which they are concerned. Like the lexicographer, we must serve the reader by explaining those words which he will meet, whether we individually use or condemn them. We feel that we have exhausted our powers in cautioning writers that certain words are rare and not likely to be understood by most readers, or are improper for any reason, and in urging the complete abandonment of those withdrawn by their proposers.

Needless words will die a natural death; needed ones we cannot kill. The good we might do in hastening the death of the moribund by omitting them from this report is less than the good we do by teaching their meaning to those who will meet them in ante-mortem print. These readers have rights. We serve no class, but the whole.

Illustrations. At the end of the several descriptions the reader is referred to good illustrations in Osmond and Stead's "Microscopic Analysis of Metals," Griffin & Co., London, 1904.

II. List of Microscopic Substances

The microscopic substances here described consist of

1. *Metarals,* true phases, like the minerals of nature. These are either elements, definite chemical compounds, or solid solutions, and hence consisting of definite substances in varying proportions. These include austenite, ferrite, cementite, and graphite.

2. *Aggregates,* like the petrographic entities as distinguished from the true minerals. These mixtures may be in definite proportions, i. e. eutectic, or eutectoid mixtures, (ledeburite, pearlite, steadite) or in indefinite proportions (troostite, sorbite). Those aggregates which are important for any reason are here described.

(Many true minerals, such as mica, felspar and hornblende, are divisible into several different species so that

these true mineral names may be either generic or specific. These genera and species are definite chemical compounds, in which one element may replace another. Other minerals, such as obsidian, are solid solutions in varying proportions, and in these also one element may replace another. Metarals like minerals differ from aggregates in being severally chemically homogeneous.)

These two classes may be cross classified into:

A. The iron-carbon series, which come into being in cooling and heating.

B. The important impurities, manganese sulphide, ferrous sulphide, slag, etc.

C. Other substances.

The most prominent members of the iron-carbon series are:

I. Molten iron, metaral, molten solution, but hardly a microscopic constituent.

II. The components which form in its solidification:

a, austenite, solid solution of carbon or iron carbide in iron, metaral;

b, cementite, definite metaral, Fe_3C;

c, graphite, definite metaral, C.

III. The transition substances which forr through the transformation of austenite during cooling:

d, martensite, metaral of variable constitution; its nature is in dispute;

e, troostite, indefinite aggregate, uncoagulated mixture;

f, sorbite, indefinite aggregate, chiefly uncoagulated pearlite plus ferrite or cementite.

IV. Products* of the transformation of austenite:

g, ferrite;

h, pearlite.

This transformation may also yield cementite and graphite as end products in addition to those under b and c.

In addition to the above, the names of which are universally recognized and in general use, the following names have been used more or less:

i, ledeburite (Wüst), definite aggregate, the austenite-cementite eutectic;

j, ferronite (Benedicks) hypothetical definite metaral, beta iron containing about 0.27 per cent of carbon;

k, steadite (Sauveur), definite aggregate, the iron-phosphorus eutectic (rare);

And three transition stages in the transformation of austenite, viz:

l, hardenite (Arnold), collective name for the austenite and martensite of eutectoid composition;

m, osmondite (Heyn), boundary stage between troostite and sorbite;

n, troosto-sorbite (Kourbatoff), indefinite aggregate, the troostite and the sorbite which lie near the boundary which separates these two aggregates; (obsolescent).

III. Definitions and Description

Carbon iron equilibrium diagram, Fig. 1. Under the several substances about to be described an indication will be given of the parts of the carbon iron equilibrium diagram Fig. 1 to which they severally correspond.

Austenite

Osmond (Fr. Austénite, Ger. Austenit, called also mixed crystals and gamma iron. Up to the year 1900 often called martensite, and wrongly sometimes still so called). Metaral of variable composition.

Definition. The iron-carbon solid solution as it exists above the transformation range or as preserved with but moderate transformation at lower temperatures, e. g. by rapid cooling, or by the presence of retarding elements, (Mn, Ni, etc.), as in 12 per cent. manganese steel and 25 per cent. nickel steel.

Constitution and Composition. A solid solution of carbon or iron carbide (probably Fe_3C) and gamma iron, normally stable only above the line PSK of the carbon iron diagram. It may have any carbon content up to saturation as shown by the line SE, viz.:—about 0.90 per cent. at S (about 725°C) to 1.7 per cent. at E (about 1130°). The theory that the iron and the carbide or carbon, instead of being dissolved in each other, are dissolved in a third substance, the solution of eutectic composition ($Fe_{24}C$ called hardenite) is not in accord with the generally accepted theory of the constitution of solutions, and is not entertained widely or by any member of this committee.

Crystallization. Isometric. The idiomorphic vug crystals are octahedra much elongated by parallel growth. The etched sections show much twinning. (Osmond and most authorities.) Le Chatelier believes it to be rhombohedral. Cleavage octahedral.

Varieties and Genesis. 1. Primary austenite formed in the solidification of carbon steel and hypo-eutectic cast iron. 2. Eutectic austenite, interstratified with eutectic cementite, making up the eutectic formed at the end of the solidification of steel containing more than about 1.7 per cent. of carbon, and of all cast iron.

Equilibrium. It is normal and in equilibrium in Region 4, and also associated with beta iron in Region 6, with alpha iron in Region 7, and with cementite in Region 5. It should normally transform into pearlite with either ferrite or cementite on cooling past A_1 into Region 8.

Transformation. In cooling slowly through the transformation range, Ar_3—Ar_1, austenite shifts its carbon content spontaneously through generating pro-eutectoid ferrite or cementite, to the eutectoid ratio, about 0.90 per cent., and then transforms with increase of volume at Ar_1 into pearlite, q. v., with which the ejected ferrite or cementite remains mixed. Rapid cooling and the presence of carbon, manganese, and nickel obstruct this transformation, (1) retarding it and (2) lowering the

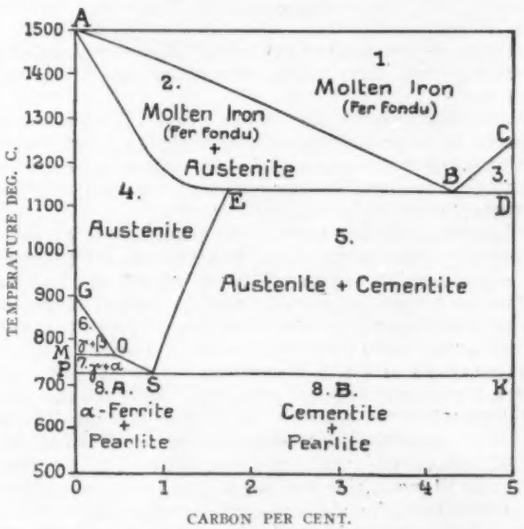


Fig. 1—A1, the line PSK is often called "A1." A3, the line GOS is often called "A3," and this name is sometimes applied to the line SE.

temperature at which it actually occurs, and in addition (3) manganese and nickel lower the temperature at which in equilibrium it is due. Hence, by combining these four obstructing agents in proper proportions the transformation may be arrested at any of the intermediate stages, martensite, troostite, or sorbite*, q. v., and if arrested in an earlier stage, it can be brought to any later desired stage by a regulated reheating or "tempering." For instance, though a very rapid cooling in the absence of the three obstructing elements checks the transformation but little and only temporarily, yet, if aided by the presence of a little carbon, it arrests the transformation wholly in the martensite stage; and in the presence of about 1.50 per cent. of carbon such cooling retains about half the austenite so little altered that it is "considerably" softer than the usually darker needles of the surrounding martensite, with which it contrasts sharply. Again, either (a) about 12 per cent. of manganese plus 1 per cent. of carbon, or (b) 25 per cent. of nickel, lower and obstruct the transformation to such a degree that austenite persists in the cold apparently unaltered, even through a slow cooling. (Hadfield's manganese steel and 25 per

*In hypo-eutectoid steels these habitually play the part of end products, though according to the belief of most the true end of the transformation is not reached till the whole has changed into a conglomerate of ferrite plus graphite.

*Though the transformation can be arrested in such a way as to leave the whole of the steel in the condition of martensite, it is doubted by some whether it can be so arrested as to leave the whole of it in any of the other transition stages. Troostite and sorbite caused by such arrest are habitually mixed, troostite with martensite or sorbite or both, and sorbite with pearlite or troostite or both.

cent. nickel steel, manganiferous and nickeliferous austenite respectively.)

Occurrence. When alone, (12 per cent. manganese and 25 per cent. nickel steel and Maurer's 2 per cent. carbon plus 2 per cent. manganese austenite) polyhedra, often coarse, much twinned at least in the presence of martensite, and readily developing slip bands. In hardened high-carbon steel it forms a ground mass pierced by zig-zag needles and lances of martensite.

Etching. All the common reagents darken it much more than cementite, less than troostite or sorbite, and usually less, though sometimes more than martensite, which is recognized by its zig-zag shape and needle structure. With ferrite and pearlite it is never associated.

Physical Properties. Maurer's austenite of 2 per cent. manganese plus 2 per cent. carbon is but little harder than soft iron, and 25 per cent. nickel steel and Hadfield's manganese steel are but moderately hard. Yet, as usually, preserved in hardened high carbon steel, the hardness of austenite does not fall very far short of that of the accompanying martensite, probably because partly transformed in cooling. (Osmond's words are that it is "considerably" softer than that martensite.)

Specific Magnetism very slight unless perhaps in intense fields. In Hadfield's manganese steel and 25 per cent. nickel steel, very ductile.

Illustrations, "Microscopic Analysis of Metals," Figs. 20, 50 and 51, on pp. 39, 100 and 101.

Cementite

(Sorby "intensely hard compound," Ger. Cementit, Fr. Cémentite, Arnold, crystallized normal carbide). Definite metaral.

Definition. Tri-ferrous carbide, Fe_3C. The name is extended by some writers so as to include tri-carbides in which part of the iron is replaced by manganese, or other elements. Such carbides may be called "manganiferous cementite," etc.

2. *Occurrence.* (a) pearlitic, as a component of pearlite, q. v.; (b) eutectic; (c) primary or pro-eutectic; (d) pro-eutectoid; (e) that liberated by the splitting up of the eutectic or of pearlite; and (f) uncoagulated in sorbite, troostite, and perhaps martensite; (c), (d) and (e) are grouped together as "free" or "massive."

Primary cementite is generated in cooling through Region 3; eutectic cementite on cooling past the line EBD; pro-eutectoid cementite in cooling through Region 5; pearlitic cementite on cooling past the line PSK, or A1. Though the several varieties of cementite are generally held to be all metastable, tending to break up into graphite plus either austenite above A1 or ferrite below A1, yet they have a considerable and often great degree of persistence. The graphitizing tendency is completely checked in the cold, but increases with the temperature, and with the proportion of carbon and of silicon present, and is opposed by the presence of manganese.

3. *Crystallization.* Orthorhombic, in plates.

4. *Structure.* (a) Pearlitic, in parallel unintersecting plates alternating with plates of ferrite; (b) Eutectic, plates forming a network filled with a fine conglomerate of pearlite with or without pro-eutectoid cementite; (c) primary, in manganiferous white cast iron, etc., in rhombohedral plates; (d) in hyper-eutectoid steel, pro-eutectoid cementite forms primarily a network enclosing meshes of pearlite, through which cementite plates or spines sometimes shoot if the network is coarse; (e) cementite liberated from pearlite merges with any neighboring cementite; (f) the structure of uncoagulated cementite cannot be made out. On long heating the pro-eutectoid and pearlitic cementite spheroidize slowly, and neighboring particles merge; (g) in white irons rich in phosphorus in flat plates embedded in iron-carbon-phosphorus eutectic.

5. *Etching,* etc. After polishing stands in relief brilliant white after etching with dilute hydrochloric or picric acid, darkened by boiling with solution of sodium picrate in excess of sodium hydrate.

6. *Physical Properties.* Hardest component of steel. Hardness=6 of Mohs scale. Scratches glass and felspar but not quartz; very brittle. Specific magnetism about two-thirds that of pure iron.

Illustrations, "Microscopic Analysis of Metals," Figs. 42 and 43 on pp. 84, 85.

Martensite

(Fr. Martensite, Ger. Martensit), Metaral. Its nature is in dispute.

Definition. The early stage in the transformation of austenite characterized by needle structure and great hardness, as in hardened high-carbon steel.

Constitution. I. (Osmond and others), a solid solution like austenite, q. v., except that the iron is partly beta, whence its hardness, and partly alpha, whence its magnetism in mild fields. II. (Le Chatelier) the same except that its iron is essentially alpha, and the hardness due to the state of solid solution. III. (Arnold) a special structural condition of his "hardenite" (austenite); not widely held. IV. A solid solution in gamma iron. V. (Benedicks.) The same as I, except that the iron is wholly beta, and that beta iron consists of alpha iron containing a definite quantity of gamma iron in solution.

Equilibrium. It is not in equilibrium in any part of the diagram, but represents a metastable condition in which the metal is caught during rapid cooling, in transit between the austenite condition stable above the line A1 and the condition of ferrite plus cementite into which the steel habitually passes on cooling slowly past the line A1.

Occurrence. The chief constituent of hardened carbon tool steels, and of medium nickel and manganese-steels. In still less fully transformed steels (1.50 per cent. carbon steel rapidly quenched, etc.), it is associated with austenite; in more fully transformed ones (lower carbon steels hardened, high carbon steels oil hardened, or water hardened and slightly tempered, or hardened thick pieces even of high carbon steel) it is associated with troostite, and with some pro-eutectoid ferrite or cementite, q. v., in hypo and hyper-eutectoid steels respectively. In tempering it first changes into troostite; at 350°—400° it passes through the stage of osmondite; at higher temperatures it changes into sorbite; at 700° into granular pearlite. On heating into the transformation range this changes into austenite, which on cooling again yields lamellar pearlite.

Characteristic specimens are had by quenching bars 1 cm square of eutectoid steel, i. e. steel containing about 0.9 per cent. of carbon in cold water from 800° C (1472° F).

Structure. When alone, habitually in flat plates made up of intersecting needles parallel to the sides of a triangle. When mixed with austenite, zig-zag needles, lances and shafts.

If produced by quenching after heating to 735° C, it consists of minute crystallites resembling the globulites of Vogelsang, which are rarely arranged in triangular order. At times so fine as to suggest being amorphous.

Etching. With picric acid, iodine, or very dilute nitric acid etches usually darker than austenite, but sometimes lighter, always darker than ferrite and cementite, but always lighter than troostite.

Illustrations, "Microscopic Analysis of Metals," Fig. 19, p. 38, Fig. 52 on p. 102.

Ferrite

(Fr. Ferrite, Ger. Ferrit). Definite metaral.

1. *Definition.* Free alpha-iron.

2. *Composition.* Nearly pure iron. It may contain a little phosphorus and silicon, but its carbon content if any is always small, at the most not more than 0.05 per cent., and perhaps never as much as 0.02 per cent.

3. *Occurrence.*. (a) pearlitic as a component of pearlite, q. v.; (b) pro-eutectoid ferrite generates in slow cooling through the transformation range; (c) that segregated from pearlite, i. e. set free by the splitting up of pearlite, especially in low carbon steel; (d) uncoagulated as in sorbite and probably troostite; (b) and (c) are classed together as free or massive.

Thus ferrite is normal and stable in Regions 7 and 8.

4. *Crystallization,* isometric, in cubes or octahedra.

5. *Structure.* (a) Pearlitic ferrite, unintersecting parallel plates alternating with plates of cementite; (b) pro-eutectoid ferrite in low-carbon steel forms irregular polygons, each with uniform internal orientation. In higher carbon steel, after moderately slow cooling, especially in the presence of manganese, it forms a network enclosing meshes of pearlite. In slower cooling this network is replaced by irregular grains separated by pearlite; (c) the ferrite set free by the splitting up of

pearlite merges with the pro-eutectoid ferrite if any; (d) the structure of the ferrite in sorbite, etc., cannot be made out.

6. *Etching.* Dilute alcoholic nitric or picric acid on light etching leaves the ferrite grains white with junctions which look dark. Deeper etching, by Heyn's reagent or its equivalent, reveals the different orientation of the crystals or grains, (a) as square figures parallel to the direction of the etched surface; (b) as plates which dip at varying angles and becomes dark or bright when the specimen is rotated under oblique illumination. Still deeper etching reveals the component tubes (etching figures, Ätzfiguren), at least if the surface is nearly parallel to the cube faces.

7. *Physical Properties.* Soft; relatively weak (tenacity about 40,000 lb. per sq. in.); very ductile; strongly ferromagnetic; coercitive force very small.

Grain Size. For important purposes (1) etch deeply enough, e. g. with copper-ammonium chloride, to reveal clearly the junctions of the grains; (2) count on a photograph of small magnification the number of grains in a measured field so drawn as to exclude fragments of grains; after (3) determining the true grain boundaries by examination under high powers (Heyn's method). Deep nitric acid etching is inaccurate, because an apparent grain boundary may contain several grains.

Illustrations, "Microscopic Analysis of Metals," Figs. 41, 56, pp. 79, 116.

Osmondite

(Fr. Osmondite, Ger. Osmondit.)

Definition. That stage in the transformation of austenite at which the solubility in dilute sulphuric acid reaches its maximum rapidity. Arbitrarily taken as the boundary between troostite and sorbite.

Earlier Definition. Defined by the Fifth Congress as having the "maximum solubility in acids and by a maximum coloration under the action of acid metallographic reagents." The present definition is confined to maximum rapidity of dissolving, because we do not yet know that this in all cases co-exists with the maximum depth of coloration, and in any case in which these two should not co-exist, the old definition does not decide which is true osmondite.

Constitution. The following hypotheses have been suggested, none of which has firm experimental foundation: 1. A solid solution of carbon or an iron carbide in alpha iron. 2. The colloidal system of Benedicks in its purity, troostite being this system while forming at the expense of martensite, and sorbite being this system coagulating and passing into pearlite. 3. The stage of maximum purity of amorphous alpha iron on the way to crystallizing into ferrite.

Occurrence. Hardened carbon steel of about 1 per cent. of carbon when reheated (tempered) to 350—400° C passes through the stage of troostite to that of osmondite, and on higher heating to that of sorbite. What variation, if any, from this temperature is needed to bring hardened steel of other carbon content to the osmondite stage is not known. In that it represents a true boundary state between troostite and sorbite it differs in meaning from troostosorbite which embraces both the troostite and the sorbite which lie near this boundary. Indeed osmondite has sometimes been used in this looser sense. Writers are cautioned that, however useful these terms may prove for making these nice discriminations, they are not likely to be familiar to general readers.

Etching. According to Heyn it differs from troostite and sorbite in being that stage in tempering which colors darkest on etching with alcoholic hydrochloric acid.

The present definition and description of osmondite should displace previous ones, because they have the express approval of Professor Heyn, the proposer of the name, and M. Osmond himself.

Ferronite

(Fr. Ferronite, Ger. Ferronit) (Benedicks) hypothetical definite metaral.

Definition. Solid solution of about 0.27 per cent. of carbon in beta iron.

Occurrence (hypothetical). In slowly cooled steels and cast iron containing 0.50 per cent. of combined carbon or more, that which is generally believed to be ferrite, whether pearlitic or free, is supposed by Benedicks to be ferronite.

Hardenite

(Fr. Hardenite, Ger. Hardenit.)

Definition. Collective name for austenite and martensite of eutectoid composition. It includes such steel (1) when above the transformation range, and (2) when hardened by rapid cooling.

Observations. On the generally accepted theory that austenite is a solid solution of carbon or an iron carbide in iron, hardenite is the solution of the lowest transformation temperature, i e. the eutectoid. The theory that instead it is a definite chemical compound, $Fe_{24}C$, is considered under Austenite. Its proposer includes under hardenite both eutectoid (0.90 per cent. carbon) austenite when above the transformation range, and the martensite into which that austenite shifts in rapid cooling (hardening).

Other Meanings. Originally (Howe, 1888) collective name for austenite and martensite of any composition in carbon steel. Osmond (1897), austenite saturated with carbon. Both these meanings are withdrawn by their proposers.

Pearlite

(Sorby's "pearly constituent." At first written "pearlyte." Fr. Perlite, Ger. Perlit.) Aggregate.

Definition. The iron-carbon eutectoid, consisting of alternate masses of ferrite and cementite.

Constitution and Composition. A conglomerate of about 6 parts of ferrite to 1 of cementite. When pure, contains about 0.90 per cent. of carbon, 99.10 per cent. of iron.

Occurrence. Results from the completion of the transformation of austenite brought spontaneously to the eutectoid carbon-content, and hence occurs in all carbon steels and cast iron containing combined carbon and cooled slowly through the transformation range, or held at temperatures in or but slightly below that range, long enough to enable the ferrite and cementite to coagulate into a mass microscopically resoluble. Hence it is the normal constituent in Region 8. Its ferrite is stable but its cementite is metastable and tends to transform into ferrite and graphite.

Varieties and Structure. Because pearlite is formed by the coagulation of the ferrite and cementite initially formed as the irresoluble emulsion, sorbite, (Arnold's sorbitic pearlite) there are the indefinitely bounded stages of sorbitic pearlite, (Arnold's normal pearlite), i. e. barely resoluble pearlite, in the border land between sorbite and laminated pearlite; granular pearlite, in which the cementite forms fine globules in a matrix of ferrite; and laminated or lamellar pearlite, consisting of fine, clearly defined, non-intersecting, parallel lamellae alternately of ferrite and cementite. The name granular pearlite was first used by Sauveur to represent what is now called sorbite. This meaning has been withdrawn.

An objection to Arnold's name "normal pearlite" is that it is likely to mislead. "Normal" here apparently refers to arising under normal conditions of cooling, but (1) it rather suggests structure normal for pearlite, which surely is the lamination characteristic of eutectics in general, and (2) the general reader has no clue as to what conditions of cooling are here called normal. Many readers are not manufacturers, and even in manufacture itself air cooling is normal for one branch and extremely slow furnace cooling for another. Arnold calls troostite "troostitic pearlite" and sorbite "sorbitic pearlite." This is contrary to general usage, which restricts pearlite to microscopically resoluble masses.

Etching. After etching with dilute alcoholic nitric or picric acid it is darker than ferrite or cementite, but lighter than sorbite and troostite. A magnification of at least 250 diameters is usually needed for resolving it into its lamellae, though the pearlite of blister steel can often be resolved with a magnification of 25 diameters. The more rapidly pearlite is formed, the higher the magnification needed for resolving it.

Illustrations, lamellar pearlite, Osmond and Stead "Microscopic Analysis," Fig. 11, p. 19; granular pearlite, idem Fig. 18, p. 36; Heyn and Bauer, Stahl und Eisen 1906, Fig. 14, opposite p. 785

Graphite

(Ger. Graphit, Fr., Graphite), definite metaral.

Definition. The free elemental carbon which occurs in iron and steel.

Composition. Probably pure carbon, identical with native graphite.

Genesis. Derived in large part, and according to Goerens wholly, from the decomposition of solid cementite. Others hold that its formation as kish may be from solution in the molten metal, and that part of the formation of temper graphite may be from elemental carbon dissolved in austenite. It is the stable form of carbon in all parts of the diagram.

Occurrence. 1. As kish, flakes which rise to the surface of molten cast iron and usually escape thence.

2. As thin plates, usually curved, e. g. in gray cast iron, representing carbon which has separated during great mobility, i. e. near the melting range.

3. As temper graphite (Ger. Temperkohle, Ledebur) pulverulent carbon which separates from cementite and austenite, especially in the annealing process for making malleablized castings.

Graphite and ferrite are sometimes associated in a way which suggests strongly that they represent a graphite-austenite eutectic. But the existence of such a true eutectic is doubted by most writers.

Properties. Hexagonal. H. 1—2. Gr. 2.255. Streak black and shining, lustre metallic; macroscopic color, iron black to dark steel gray, but always black when seen in polished sections of iron or steel under the microscope; opaque; sectile; soils paper; flexible; feel, greasy.

Troostite

(Fr. Troostite, Ger. Troostit.) Probably aggregate. (Arnold, troostitic pearlite.)

Definition. In the transformation of austenite, the stage following martensite and preceding sorbite (and osmondite if this stage is recognized).

Constitution and Composition. An uncoagulated conglomerate of the transition stages. The degree of completeness of the transformation represented by it is not definitely known and probably varies widely. Osmond and most others believe that the transformation, while generally far advanced, yet falls materially short of completion; but Benedicks and Arnold (9) believe that it is complete. The former belief that it is a definite phase, e. g. a solid solution of carbon or an iron carbide in either β or γ iron, is abandoned. Its carbon-content like that of austenite and martensite varies widely.

Occurrence. It arises either on reheating hardened (e. g. martensitic steel) to slightly below 400°, or on cooling through the transformation range at an intermediate rate, e. g. in small pieces of steel when quenched in oil, or quenched in water from the middle of the transformation range, or in the middle of larger pieces quenched in water from above the transformation range. With slightly farther reheating it changes into sorbite; with higher heating into sorbitic pearlite, then slowly into granular pearlite, and probably indirectly into lamellar pearlite. It occurs in irregular, fine-granular or almost amorphous areas, colored darker by the common etching reagents than the martensite or sorbite accompanying it. A further common means of distinguishing it from sorbite is that it is habitually associated with martensite, whereas sorbite is habitually associated with pearlite.

Areas near the boundary between troostite and sorbite are sometimes called troosto-sorbite.

Properties. Hardness, intermediate between that of the martensitic and the pearlitic state corresponding to the carbon content of the specimen. In general the hardness increases, the elastic limit rises, and the ductility decreases, as the carbon-content increases. Its ductility is increased rapidly and its hardness and elastic limit lowered rapidly by further tempering, which affects it much more markedly than sorbite.

Sorbite

(Fr. Sorbite, Ger. Sorbit.) Aggregate. (Arnold, sorbitic pearlite.)

Definition. In the transformation of austenite, the stage following troostite and osmondite, if this stage is recognized, and preceding pearlite.

Constitution and Composition. Most writers believe that it is essentially an uncoagulated conglomerate of irresoluble pearlite with ferrite in hypo and cementite in hyper-eutectoid steels respectively, but that it often contains some incompletely transformed matter.

Occurrence. The transformation can be brought to the sorbitic stage (1) by reheating hardened steel to a little above 400°, but not to 700°, at which temperature it coagulates into granular pearlite; (2) by quenching small pieces of steel in oil or molten lead or even by air-cooling them; (3) by quenching in water from just above the bottom of the transformation range, Ar_1 Sorbite is ill-defined, almost amorphous, and is colored lighter than troostite but darker than pearlite by the usual etching reagents. It differs further from troostite in being softer for given carbon content, and usually in being associated with pearlite instead of martensite, and from pearlite in being irresoluble into separate particles of ferrite and cementite.

As sorbite is essentially a mode of aggregation, it cannot properly be represented on the equilibrium diagram. Its components at all times tend to coagulate into pearlite, yet it remains in its uncoagulated state at all temperatures below 400°.

Properties. Though slightly less ductile than pearlitic steel for given carbon content, its tenacity and elastic limit are so high that a higher combination of these three properties can be had in sorbitic than in pearlitic steels by selecting a carbon content slightly lower than would be used for a pearlitic steel. Hence the use of sorbitic steels, e. g., first hardened and then annealed cautiously, for structural purposes needing the best quality.

Manganese Sulphide

(Fr. Sulphure de Manganese, Ger. Schwefelmangan), MnS, (Arnold and Waterhouse). Metaral.

Occurrence, etc. Sulphur combines with the manganese present in preference to the iron, forming pale dove or slate gray masses, rounded in castings, elongated in forgings.

Ferrous Sulphide

(Fr. Sulphure de Fer, Ger. Schwefeleisen), FeS. Metaral.

Occurrence. The sulphur not taken up by the manganese forms ferrous sulphide, FeS, which, probably associated in part with iron as an Fe—FeS eutectic, forms by preference more or less continuous membranes surrounding the grains of pearlite. Color, yellow, or pale brown.

Sulphur Prints. When silk impregnated with mercuric chloride and hydrochloric acid (Heyn's and Bauer's method) or bromide paper moistened with sulphuric acid (Baumann's method) is pressed on polished steel, the position of the sulphur-bearing areas, whether of FeS or MnS, records itself by the local blackening which the evolved H_2S causes. Phosphorus-bearing areas also blacken Baumann's bromide paper.

Miscellaneous

Eutectoid, Saturated, Etc. The iron carbon eutectoid is pearlite. Steel with more carbon than pearlite is called hyper-eutectoid, that with less is called hypo-eutectoid. Arnold's names "saturated," "unsaturated," and "supersaturated," for eutectoid, hypo-eutectoid, and hyper-eutectoid steel, respectively, have considerable industrial use in English speaking countries, but are avoided by most scientific writers on the ground that they are misleading, because, e. g. there is only one specific temperature, A1, at which eutectoid steel is actually saturated, and, if any other temperature is in mind, that steel is not saturated. Above A1 it is clearly undersaturated.

The objection to the names sorbite, troostite, martensite, and austenite, that each of them covers steel of a wide range of carbon content, is to be dismissed because a like objection applies with equal force to every generic name in existence.

The theoretical matter in this report is given solely for exposition and the committee disclaims the intent to impose any theory. This report is offered for adoption subject to this disclaimer on the ground that the adoption of theories is beyond the powers of a Congress.

Electric Melting of Ferromanganese

Melting the Alloy in Different Furnaces—Practical Details Such as the Presence and Condition of Slag—Operating Costs

Several articles have already been published on the melting of ferromanganese in the electric furnace for use in steel making, but in Stahl und Eisen, March 14, 1912, there is an illuminating paper and discussion on this subject. The writer is R. Korten, general superintendent of the Burbachhütte, who gives an account of the results obtained while melting approximately 2000 tons of alloy in a Keller furnace for further use in the plant. The furnace was freshly lined with magnesite, August 2, 1911, and has been in continuous operation since then without developing the slightest trouble. During this time it was stopped three times on Sundays, due to lack of current, and the opportunity was taken to make some repairs to the lining. The brickwork and the acid roof have stood for over four months. The extremely small amount of repairing necessary allows a life of 6 to 9 months to be figured on, which means that 1200 to 2000 tons of ferromanganese may be melted, so that the repair costs per ton are extremely low. The hearth and the iron rods are still intact.

Requirements to Minimize Vaporization of Manganese

Melting without loss of manganese by vaporization is the most certain according to Herr Korten if a low tension is used. The arc must be short and the hearth must offer as large a surface as possible. Also one must seek to produce a uniform heating over a large surface and not an intense heating over a small surface. The method of working followed is that given out by Keller in 1903, in one of his patents, where he says that very low tension currents must be used in order to avoid vaporization of the manganese.

The economy of the process depends on the method of working and is greatly influenced by the capacity of the electric furnace chosen. A large capacity is unavoidable in order to satisfy all the requirements of the steel works, but it should not be too big as otherwise too large a bath has to be kept liquid, which very considerably increases the power consumption and the cost of melting. This latter requirement is somewhat difficult to reconcile with the widely varying daily ferromanganese consumption of most steel works. The melting costs can be considerably lowered if the alloy is first heated to a clear red and then charged in the electric furnace. In this way no work is done in the electric furnace that can be done more cheaply in an ordinary furnace.

Finally may be mentioned another method of operating that is suitable to minimize the cost of melting. This is the use of a small amount of silicon in the place of ferromanganese. Herr Korten has been using an alloy with about 76 per cent. manganese and 4 per cent. silicon for a considerable time. As one part of silicon replaces four of manganese this gives a direct saving when one considers the present price of 80 per cent. ferromanganese and 90 per cent. ferrosilicon. Further a lower amount of alloy is needed and the melting point is lowered. The total saving brought about is very considerable.

Experiences in Melting Ferromanganese

The discussion was opened by Dr. A. Müller of Oberhausen, who had carried out a 54-hr. test with a 3-ton Girod furnace. Altogether 18.5 tons of 75 per cent. ferromanganese was melted. The alloy was charged in about 6-in. pieces into the furnace, which was at about 1300 deg. C. from the preceding hard steel heat. Then hourly certain amounts of cold ferromanganese were charged, melted, overheated and cast. For melting, the same current strength was used as for scrap, namely, 45 volts and 5000 amperes, and the current consumption per metric ton was 881 kwhr., which can be considered as good. A bath of 2½ tons was maintained in the furnace. The best period of melting new cold additions was with a current of 40 to 45 volts and 7200 to 7800 amperes. The power used per hour was 350 kw., the output per hour was 882 lb. of thoroughly liquid material, and the power consumption was 875 kwhr. per metric ton. When the voltage was lower, namely 35 to 40, the results were not so favorable, nor when it was higher, at 45 to 50 volts.

The degree of overheating necessary for continuous practical operation was determined by pouring 220 to 440 lb. into a preheated ladle every 15 to 30 min. and emptying this after holding from 1 to 2 min. During the fourth melting period the current was held at 45 to 50 volts and 7000 to 7600 amperes. The current used per hour was 377 kw., and the power consumption was 918 kwhr. per metric ton. The temperature of the liquid metal was so much above the melting point that 100 lb. were held in the ladle for 2½ min. and then poured without leaving any skull. The temperature shortly before pouring from the furnace was 1270 deg. C.

Advantages of the Slag Formations

The formation of a slag is necessary to protect the bath from oxidation and volatilization of the manganese. As soon, therefore, as about 1100 lb. of alloy were melted a good slag covering was made, and air excluded from the furnace as much as possible. The melting or volatilization loss during the test was practically nothing. An average of ten samples of the metal charged, and thirteen of that tapped from the furnace gave:

	Carbon.	Sulphur.	Phosphorus.	Manganese.	Silicon.	Iron.
Charged	5.87	0.013	0.43	75.02	1.68	16.49
Tapped	5.68	0.010	0.39	74.90	1.54	16.94

The results show that with proper melting in the arc furnace there is no important loss of manganese, even with a tension at the arcs of 50 volts.

Loss of manganese can be brought about by the oxidizing action of the slag on the metal, caused by the slag taking up oxygen from the air with the formation of oxide of iron. The analyses in Table I show clearly that the acid slags should be avoided both because of the basic

Table I. Composition and Properties of the Slag.

No.	Material used.	SiO_2 Per ct.	Al_2O_3 Per ct.	CaO Per ct.	MgO Per ct.	FeO Per ct.	MnO Per ct.	P_2O_5 Per ct.	S Per ct.	C O Per ct.	Ratio of bases to O of acids	Properties of slags.
1	88.2 lb. lime, 17.6 lb. fluorspar, 6.6 lb. sand	37.95	0.26	43.70	9.90	1.26	4.37	0.01	0.46	0.39	18/20	Green, did not slack in air.
2	After lime and powdered petroleum coke had been added	25.40	0.47	51.75	12.50	0.63	1.58	N.D.	0.55	0.25	20/14	Grayish green, did not slack in air.
3	After more lime and coke had been added	19.55	0.75	58.25	5.20	0.63	0.77	0.01	1.06	0.23	19/10	Grayish white, did not slack in air. Smelt strongly of garlic.
4	After more lime and coke had been added	7.22	0.13	65.55	9.92	0.51	0.81	0.01	1.22	1.42	23/4	Slacked in air to gray powder. Smelt strongly of garlic.

furnace lining and the fact that they retain more manganese than the basic slags.

The slags contain more oxide of manganese than of iron because the former is the more easily produced and harder to reduce. By adding lime, highly basic slags are made that are freed from oxide by the action of the electrodes and the repeated addition of petroleum coke. They also desulphurize, as in the steel refining process, shown by their sulphur content. Such slags fall to powder when exposed to air, and smell strongly of garlic.

The test has shown that the total manganese loss with continuous operation will not be more than 1 to 2 per cent. The dolomite furnace lining does not suffer more than with steel melting and refining, and will be affected still less with continuous operation, because of the much lower temperatures. If the Girod furnace were prepared specially for melting ferromanganese, that is if the hearth extended behind the doors to allow preheating of the charge and radiation were prevented by lowering the roof and making the walls very thick, then the power consumption would be considerably lowered, especially if the alloy could be charged hot. The results prove that ferromanganese can be economically melted and there should remain no question about introducing the electric furnace as a melting furnace, because of its simple, neat and quantitative operation and the improvement brought about in the quality of the steel due to the use of liquid ferromanganese.

Other Successful Electric Furnace Experiences

The next speaker was P. Boehm, of the Friedenshütte, who gave an account of his experience in melting ferromanganese in a Nathusius furnace, which was connected to the ordinary plant three-phase 50-cycle 6000-volt current. This current was lowered to the proper voltage in a transformer. The idea of using molten ferromanganese was first taken up in June, 1910, and a long test soon convinced them that great advantages were the result, both technical and economical. A special 3-ton Nathusius furnace was installed for this purpose alone, and has been in operation for about nine months. There has been no cause for complaint, and it has been run day and night without interruption, and as has been reported for the Keller furnace the life of the hearth, walls and roof were remarkably good.

The furnace is charged Sunday afternoon and the current switched on, so that 3 o'clock Monday morning a fluid 3-ton bath is ready, and this is maintained all the week. The succeeding ferromanganese charge is placed just inside the doors where it is preheated, and then pushed into the bath. The liquid metal is tapped into a ladle that is combined with a hanging scale and then poured into the steel. It has been noticed that cold heats, which would only take up cold ferromanganese with difficulty, show the proper manganese when liquid additions are made. The melting process is simple and needs little attention, but care must be taken against overheating, which immediately causes loss and is shown by the appearance of much brownish smoke. Therefore a good slag must be made, and fine lime is used, the slag being reduced with small coke. The 3-ton furnace has proved completely satisfactory for a daily output of 1000 tons of steel.

Cost of Electrically Melting Ferromanganese

In regard to costs the following figures have been carefully worked out. For preheating ferromanganese in a furnace with direct firing the cost per metric ton is 4.31 marks ($1.02). This is based on a yearly consumption of 3300 tons and includes the fuel, wages, lining and repairs of the furnace and 10 per cent. depreciation and amortization. The total costs for melting a metric ton in the Nathusius furnace are 19.60 marks ($4.66), divided as follows: Power used, 800 kwhr. at 1.8 pf. a kwhr. or 14.40 marks. Electrode consumption of about 11 lb. per metric ton amounts to 1.66 marks. Furnace lining and repairs amount to 0.50 mark and 10 per cent. depreciation and amortization, with the plant costing 40,000 marks, and a yearly output of 2310 tons, amounts to 1.74 marks.

Experience has shown that under the conditions at Friedenshütte 17.2 lb. of heated ferromanganese are used per ton of steel. With a price of 170 marks per ton this equals 1.36 marks ($0.32). With the use of liquid ferromanganese, only 12.1 lb. per metric ton are necessary, a saving of 30 per cent. With the same price for the alloy this amounts to 1.04 marks per ton ($0.25). It is believed that still greater saving can be brought about, especially by using the bottom electrodes of the furnace more and so avoiding loss of manganese.

Ferromanganese Melting on a Large Scale

H. Röchling said that it was evident that all the furnaces mentioned were suitable for melting ferromanganese. The main question was which was the most economical. If a single-phase current was necessary, then there would be immediately a loss of 20 per cent. due to the necessity of using transformers.

In regard to the advantages of using liquid ferromanganese, his own plant was extremely busy. Fifty heats per shift for one converter were not unusual. Due to this increase in speed more manganese is wasted. Formerly 11 to 13.2 lb. of ferromanganese per metric ton of steel was the normal amount, but now 16.5 to 17.6 lb. are necessary in almost every basic bessemer plant. This increases the interest in the ferromanganese melting furnace, for experience has shown that a quicker taking up of the manganese by the steel is brought about. For this reason this method is to be the more recommended the larger the plant, and the larger the number of heats produced per shift. A further advantage is the more ductile quality of steel produced.

W. Eilender, of Remscheid, the next speaker, asked whether it was true that the steel hearth electrodes in the Girod furnace were attacked by the molten ferro-manganese and rendered brittle so that the water could penetrate. He disagreed with Herr Korten in regard to a low voltage being necessary, or that the Keller furnace offered special advantages. In Remscheid an ordinary electric steel furnace had been used with success. He also questioned the accuracy of the temperature measurements of slag reported by Dr. Müller, and asked whether experience had shown the best ratio of the furnace size to the hourly requirement of molten ferromanganese.

Furnace Size and Construction

Dr. Nathusius, of Friedenshütte, was the next speaker. He considered that Herr Korten's emphatic statements in regard to a low voltage being absolutely necessary with are furnaces should be changed to read that the furnaces should be worked with arcs of the smallest possible intensity. This is conveniently brought about by using three electrodes instead of one, and the further advantage is obtained that these electrodes may be connected to the three-phase current of the plant, doing away with a 15 to 20 per cent. loss. He then spoke further in support of his own furnace.

He disagreed with the proposal that the alloy should be preheated in an ordinary furnace and then charged into the electric furnace, for the latter furnace could easily be so constructed that the alloy is preheated by the waste gases before being pushed into the bath. No bad influence of the molten bath on the bottom electrodes had been noticed at Friedenshütte, nor indeed is possible because they are covered with a thick layer of magnesite. The best temperature at which to hold the bath is 1400 to 1500 deg. C. in the opinion of Dr. Nathusius, which seems rather high. At this temperature the bath must be carefully protected from air by a proper slag covering and tight furnace construction. In regard to the size of furnace desirable he suggests a general rule that the furnace must have the same capacity as the total consumption of ferromanganese per shift. For instance if 40 heats are made in 12 hours, and each one requires 50 kg. liquid alloy, then the total consumption is $40 \times 50 = 2000$ kg., so that the furnace should be of 2 tons capacity.

Dr. Müller replied to a previous question that the liquid ferromanganese did not attack the steel poles in the hearth of the Girod furnace, which was to be expected from the low temperature of the bath, and also the previous good results with the Keller furnace. In regard to the slag temperature it must be remembered that the values given were taken after holding for more than 2 min. in the ladle. In operation it is better to hold the slag in the furnace and cover the ferromanganese in the ladle with charcoal or waste coke breeze.

Herr Thiele was mostly interested in the question from its qualitative side. The steel plants are now pushed to their limit and ferromanganese is often used in ways that cannot be considered good from a metallurgical stand-

point. Already a series of complaints have been received due to this defective practice.

Dr. Th. Geilenkirchen, Remscheid, agreed with one of the previous speakers that the voltage of the current exercised no effect on the alloy melted. He believed also that the widespread opinion that a low voltage is necessary to melt ferromanganese without loss arose from the fact that the first furnaces used could only work with a low voltage. The important point is not the strength of the current but the protection of the molten metal from the air and the avoidance of an unnecessarily high temperature.

The kind of current used is also unimportant except that in plants that are supplied with three-phase current a furnace that can use this current direct has an advantage, because the transformer losses are avoided. He also believed that it is of merely theoretical importance how the electricity is changed over into heat whether by means of arcs, resistance or induction. The discussion was closed by Herr Schroeder who, in reply to a question, said that his figure of 20 marks ($4.76) for the melting of a metric ton of ferromanganese, electrically, referred to cold alloy that was first heated near the doors and then pushed into the bath. G. B. W.

To Advertise Pittsburgh

An all-steel train, known as the "Made-in-Pittsburgh" train, left Pittsburgh September 9 at midnight on a trip of some 5000 miles into 18 states and 36 cities of the Central States and Southwest, carrying exhibits of local manufacturerd products under the auspices of the Pittsburgh Chamber of Commerce. More than 100 business men took the 18-day trip.

Practically every inch of the special train is the product of local plants. The axles, wheels, bell, boiler, tubes, valves, and rods of the locomotive bear brass labels of the plants producing them. The same is true of the cars. Four 60-ft. steel cars will be used en route as exhibition halls and moving picture theaters to show the industrial side of Pittsburgh. A four-page newspaper will be published on the train every day.

The following is a list of the exhibitors: Bell Telephone Company, Braeburn Steel Company, Carnegie Steel Company, Duff Mfg. Company, Follansbee Brothers & Co., Heeren Brothers Company, Joseph Horne Company, pany, Heeren Brothers Company, Joseph Horne Company, W. L. Hughes Company, C. G. Hussey & Co., Jones & Laughlin Steel Company, W. W. Lawrence & Co., Lutz & Schramm Company, National Electric Shoe Shining Machine Company, Pittsburgh-Buffalo Company, Pittsburgh Industrial Development Commission, Pittsburgh Lamp & Brass Company, Pittsburgh Steel Company, Pittsburgh Sanitary Mfg. Company, Pittsburgh Visible Typewriter Company, Safety Armorite Conduit Company, Standard Chain Company, Western Forge & Tool Company, Western Union Telegraph Company and Wolfe Brush Company.

Philadelphia Foundrymen's Association

The Philadelphia Foundrymen's Association held its regular monthly meeting at the Hotel Walton on the evening of September 4, this being the first meeting following the usual summer recess. In the absence of President Thomas Devlin, who was representing the association at the convention of the Atlantic Deeper Waterways Association, at New London, Conn., James H. Sterling occupied the chair. Owing to the illness of Howard Evans, secretary, August A. Miller, of *The Iron Age,* served in that capacity. Previous to the meeting about 40 members participated in a dinner.

After the transaction of routine business A. W. Moyer, of the Rockwell Furnace Company, New York, read a paper on "Ovens for Baking Cores, Mold Drying, and Annealing Steel Castings," illustrated with a large number of lantern slides. The construction of several types of ovens was shown and the merits of the various fuels used were treated at length. Statistics in connection with costs under varying conditions were presented. A general discussion followed the reading of the paper.

The Ford Motor Company, Detroit, Mich., according to its advertising department, will use more than 90,000 tons of steel in building automobiles in the coming year.

Sheet and Tube Works Profit Sharing

President James A. Campbell, of Youngstown, on the Workings of His Company's Plan

Complying with a request of *The Iron Age,* James A. Campbell, president of the Youngstown Sheet & Tube Company, Youngstown, Ohio, furnishes the following details of the profit sharing system under which the company will pay to its employees as a bonus about 5 per cent. of the wages earned by them in the year preceding June 30, 1912:

"We are paying to all of our employees who were with us on the 30th day of June, or the last day of our fiscal year, what is equal to 5 per cent. of the wages earned by them during the year. We have a system of profit-sharing whereby a certain percentage of our profits is taken out first, on the capital and surplus invested in the business and then a certain percentage of the remainder goes to the works' employees who are eligible. That is, we do not pay any proportion of this to the Sons of Vulcan, who work under an arrangement made by their labor organization, and the money that would go to them is set aside for the benefit of the stockholders. Then a certain percentage goes to the employees in other departments, namely, in the office, in the sales department and every one except elective officers of the company.

"Our earnings have been quite small comparatively speaking since this profit-sharing was put into effect, or during the years ending June 30, 1910, 1911 and 1912, and for this reason, based on the sliding scale that we have figured out, they would have received a trifle less each year than 5 per cent. on their wages. But our directors are of the opinion that when profit-sharing is justified by the earnings of a company the minimum should be at least 5 per cent. of the wages. We are in hopes that we may have more prosperous times in the future and that we can divide a greater percentage than this with our employees.

"We have made some changes in our plans for the coming year, however, that require all employees eligible to be in our service at least six months unless interrupted by sickness or accident.

"Our payroll for the year was over $5,000,000, but the amount actually paid out in bonuses will probably be a trifle less than $225,000. We do not have the actual figures as yet, and probably will not have for a couple of months, as we find that sometimes people are overlooked in the distribution and are paid later on.

"As to whether the plan is profitable or not, will say that we never expected it to be profitable to the company. Under the old plan, we went on from year to year, sometimes making money and sometimes not, but we believe where our employees are loyal to the company, and especially where they remain in our service year after year, they are entitled to something beyond the ordinary rate of wages which are paid in this district. Our idea has been that if we offered this incentive for loyal and continuous services, the company would not only earn what it would ordinarily, but that it might earn some additional money which we feel would largely belong to the employees because of their faithful, continuous and efficient services. Whether this is true or not, of course, we are unable to determine; that is, whether the earnings of the company are sufficient under this arrangement to pay the employees their proportion over and above the ordinary amount the company would earn in the old way, we cannot say. We are in hopes, however, that this may be the result, so that there would be no actual loss to the stockholders. We cannot believe, however, that under any circumstances there could be a gain to the stockholders under this arrangement, except that after a period of two or three years, if the men remained continuously in the employ of the company, they would become more proficient in their work and that we might, in addition, have less labor troubles, and on the whole, that the organization could be handled with less interruption, which, of course, would be beneficial to the stockholders."

The purchasing department of the Kelley Island Lime & Transport Company is being moved from Marblehead, Ohio, to Cleveland, Ohio. This work was begun September 2 and is expected will be completed shortly.

Metallurgy in the Congress on Chemistry

One of the 24 sections of the International Congress of Applied Chemistry now in session at Columbia University, New York City, is devoted to mining and metallurgy, and on the first session of Friday morning, September 6, a series of papers were considered covering metallurgical questions on iron and steel. Many of the papers were contributed by members of the American Institute of Mining Engineers, the session being a joint one with the Institute, but largely owing to the fact that the session was one of the numerous simultaneous sessions scheduled for the first day many of the authors and some of the would-be participants did not succeed seemingly in locating the place of meeting. The result was that practically all the papers were read merely by title and without discussion, but so far as the papers coming from the American Institute of Mining Engineers is concerned, these are to be included among the papers scheduled for presentation at the meeting of the Institute in Cleveland October 29, 30 and 31.

One of the papers which the author summarized was a discussion of "The Influence of Titanium on the Strength of Iron Castings," by Prof. Bradley Stoughton. He referred to the property of titanium of giving hardness, strength and toughness to the casting and referred to its usefulness in steel rails. He referred to the cleansing influence of titanium, a fact which appears to explain its value in minimizing segregation. He emphasized that the addition of titanium to iron and steel must be done properly. Reference was made by the chairman of the section, Prof. Joseph W. Richards, Lehigh University, to advertisements which urged that titanium should not be used in conjunction with aluminum, and in reply Professor Stoughton admitted the prevalence of contradictory statements regarding the use of titanium in the presence of both aluminum and carbon, but he had been unable to learn that there was any basis of fact for them.

Another one of the papers was by N. S. MacCollum and described the bifurcated spout devised for securing large production from the open-hearth furnace in the works of the Phoenix Iron Company. This novelty in open-hearth practice was illustrated, it will be recalled, in *The Iron Age* of October 20, 1910.

Crucible Steel Company's New Syracuse Plant

The Crucible Steel Company of America, Pittsburgh, has bought a site of about 19 acres in Syracuse, N. Y., on which it will build a plant for the manufacture of fine tool steels. It will have about twice the capacity of the present Sanderson works of the company, also located in Syracuse, and will largely use electricity for power. This new works will give the Crucible Steel Company a total of 16 plants in various parts of the country. Its new open hearth steel plant at Midland, Pa., is progressing rapidly, and it should be producing steel early in 1913. In its Atha works at Harrison, N. J., a Heroult electric steel furnace will soon be ready for operation.

The General Electric Company, Erie, Pa., is installing a large car type accurate temperature heat treating furnace built by the Rockwell Furnace Company, 26 Cortlandt Street, New York. Oil will be used as fuel. The Rockwell Furnace Company reports, among other contracts, the following: Canadian Westinghouse Mfg. Company, Hamilton, Ont., for an extensive installation of reel type core ovens, burning fuel oil; Union Iron Works, Erie, Pa., for the installation of a complete furnace equipment, consisting of large plate and rivet heating furnace and fuel oil pumping system; through Geo. B. Norcross & Co., Cleveland, O., Rockwell district sales agents, a contract with the Russel Wheel & Foundry Company, Detroit, Mich., for accurate temperature car type furnaces for heat treating automobile forgings.

Takata & Co., of Tokio, New York and London, have recently placed contracts for equipment for extensions to be built at the Imperial Steel Works at Yakamatsu, Japan. The business went to the Gütehoffnungshütte and the Deutsche Maschinenfabrik, of Duisburg, Germany, in competition with firms in the United States and Great Britain.

The Steel Corporation's Unfilled Orders

The report of unfilled tonnage on the books of Steel Corporation subsidiaries August 31 shows a total of 6,163,375 tons, an increase in the month of 206,296 tons. The total is the largest since September 30, 1907. The statements beginning with January, 1911, when the first monthly figures were given out, are as follows:

August 31, 1912	6,163,375	October 31, 1911	3,694,328
July 31, 1912	5,957,079	September 30, 1911	3,611,317
June 30, 1912	5,807,346	August 31, 1911	3,695,985
May 31, 1912	5,750,983	July 31, 1911	3,584,085
April 30, 1912	5,664,885	June 30, 1911	3,361,058
March 31, 1912	5,304,841	May 31, 1911	3,113,187
February 29, 1912	5,454,200	April 30, 1911	3,218,704
January 31, 1912	5,379,721	March 31, 1911	3,447,301
December 31, 1911	5,084,761	February 28, 1911	3,400,543
November 30, 1911	4,141,955	January 31, 1911	3,110,919

The totals at the close of the various years have been as follows: 1902, 5,347,523 tons; 1903, 3,215,123 tons; 1904, 4,696,203 tons; 1905, 7,605,086 tons; 1906, 8,498,719 tons (the high record); 1907, 4,624,552 tons; 1908, 3,603,527 tons; 1909, 5,927,031 tons; 1910, 2,674,757 tons; 1911, 5,084,761 tons.

Engineering Professors Working in Shops

Entered on the regular pay roll of the Westinghouse Electric & Mfg. Company's works at East Pittsburgh, Pa., this summer is an interesting group of employees consisting of the members of engineering faculties of several of the most important technical schools in the United States. This group consists of 29 men from 25 different colleges located in 19 States. Believing the most effective way of learning the practical side of engineering and fitting themselves to instruct their pupils was to engage in the work themselves, these men have given up their vacation periods to engage in actual manual labor, manufacturing the various types of electrical apparatus produced at the Westinghouse works.

The company was quite willing to co-operate with the professors and to encourage a closer union between educational institutions and manufacturing concerns. They are engaged as regular employees and are assigned check numbers the same as the other employees. The course includes regular work in the shops and trips after working hours through the works to inspect the various pieces of apparatus. These tours are under the guidance of the engineers who design the various pieces of apparatus inspected. As an indication of the earnestness with which these men are following their work, it is interesting to note that although these trips are taken after working hours, and before the evening meal, yet the attendance has averaged over 90 per cent. of the men in the course. Prof. Geo. B. Thomas, of Colorado College, Colorado Springs, Colo., has been selected by the Westinghouse Company to take charge of his co-laborers and lay out plans for their work.

The Youngstown Sheet & Tube Company, Youngstown, Ohio, has bought the Struthers plant of the American Sheet & Tin Plate Company at Struthers, Ohio. The plant has been inactive for some time. About half of it will be used by the Western Conduit Company, which will occupy what is known as the old mill, now being remodeled, and a small brick and steel addition, 50 x 80 ft., is being erected, to contain dipping tanks and baking ovens. The steel work for this addition as well as for a monorail tramway system will be furnished by the Brown Hoisting Machinery Company, Cleveland, Ohio, which will also supply housings, trolleys, etc., in connection with the transportation system. The so-called "new mill" at the plant, 120 x 450 ft., will be used as a storage warehouse for fencing and other wire products.

The Pennsylvania Railroad has asked manufacturers of boring mills to estimate on building a special machine for boring locomotive driving boxes on specifications furnished by the company. It is understood that no machine was found in the market which met the requirements.

The L. Beckman Company, Toledo, Ohio, manufacturer of surveying instruments, has just completed a new factory at Jackson avenue and Tenth street. The building is 40 x 108 ft., two stories. In addition an administration building has been erected.

New Tools and Appliances

This is essentially a news department for which information is invited.

Slotting Machine.—For slotting keyways in milling cutters and small parts such as enter into the manufacture of firearms, motor cycles, sewing machines, typewriters, etc., the Swind Machinery Company, Bourse Building, Philadelphia, Pa., has brought out a high speed slotting machine. There is a vertical tool slide and a horizontal work slide which is gibbed in the body of the machine and serves as a fixture for holding the work. If it is desired to replace the latter slide with another slide or fixture, especially designed for a given class of work, this can be easily done by turning a small handle in front of the machine. Automatic feeding and relieving of the tool is secured by the movement of the work slide which is advanced for feeding the work to the tool in intermittent steps between which there is a short reverse motion withdrawing the work from the tool during the upward stroke. This feeding movement is derived from the tool slide, which has two lugs on the left side that alternately engage a short lever or finger. This finger is attached to a rockshaft that in turn is connected with the feed mechanism by a vertical rod. There is an automatic stop for the feed mechanism that can be set for any predetermined depth of cut and thus enables parts to be duplicated within close limits. When the feed mechanism is in action the upper lug strikes the finger of the rockshaft when the tool slide reaches the end of its downward stroke and this imparts a vertical reciprocating motion to the rod in the rear, which has a cam-shaped end. This rod transmits motion to a horizontal feed bar which in turn gives a reverse movement to the tool slide for relieving the tool on the upward stroke. When the top of the stroke is reached the lower lug engages the rockshaft finger and the resulting motion operates a ratchet and pawl mechanism which, in connection with a screw on the feed bar serves to advance the work slide automatically, a distance equal to the feed desired. The capacity of the machine is 3/8-in. keyways in cast iron and 5/16-in. keyways in steel. The maximum length of stroke is 2 in., and a bench space of 16 x 16 in. is required.

Automatic Planing Machine Stop.—For automatically stopping a planing machine when the tool has reached a predetermined point and thus preventing spoiled work, Charles H. Usher, superintendent of the Lamb Knitting Machine Company, Chicopee Falls, Mass., has designed an automatic stop which is being made by this company. One of the methods employed throws out the feed gear and the other shifts the belt on the countershaft and holds the belt shifter, thus acting to prevent accidental starting of the machine, as sometimes happens. Either the horizontal or vertical feed can be controlled as may be desired and the devices are simple in construction and principle of operation. In the first a gear is driven from the feed screw of the cross rail and actuates a worm which in turn drives the knock-off disk by a bevel pinion through bevel teeth on the rear of the disk. The ratio of the worm and gearing is such that the disk makes one complete revolution during the time the tool point moves the entire width of the table. The disk carries a small knock-off finger which trips a small bell crank and lifts the plunger, that in turn releases the sliding gear and allows a coil spring to throw them out of mesh, thus effectually stopping the feed. In the other device the knock-off pin throws an arm and releases a clutch which holds the belt shifter. A coil spring then throws the shifter into the off position and holds it here until it is replaced by the operator. The disks on both devices, which are graduated to read in inches and fractions, can be used for setting for any class of work. As it is held in contact with the driving pinion by a light spring, it is possible to set the disk instantly by moving it forward out of mesh and turning it to the desired position.

Tool Post Grinding Machine.—A tool post grinding machine is being made by G. Horvath, 190 Hague avenue, Detroit, Michigan, which consists of an angle plate bolted to the tool slide. The vertical member of the angle plate is a V-slide to which the spindle bearing is fitted and a screw and ball handle provide means for adjusting the spindle hight. The front bearing of the spindle is conical and the rear one, cylindrical, both having means for taking up wear. The front end of the spindle is internally threaded so that extension pieces can be screwed in when internal work is to be ground. The machine is intended to be driven by a belt from an overhead countershaft, a pulley being provided on the rear end of the spindle for this purpose.

Tool Holder.—The Double Grip Tool Company, Belleville, N. J., has developed a new tool holder in which either round or square stock of any desired length can be used. In addition to the customary set screw near the end of the holder the tool is gripped by a gib which rests upon it for almost its entire length. The tool post screw bears upon the top of this gib when the holder is placed in the machine and clamps both the holder and the tool.

Self-Holding Screw Driver.—L. P. Watson, Port Huron, Mich., has developed a screw driver which is intended especially for use where very small screws have to be put in in assembling work. This tool is made of tempered spring steel with a split end and when compressed in the slot in the screw head will hold it firmly while it is being entered in the hole.

Electric Welding Machine.—For the spot welding of pipe the Winfield Electric Welding Machine Company, Warren, Ohio, has built a special design of 36-in. spot welding machine. The minimum diameter of pipe handled is 3 in. and the maximum thickness of the walls is ¼ in. There is a swiveling head and a combination double-pole, non-arcing automatic switch and circuit cut-out. The welder points, which measure 1 in. are water-cooled and are brought together either by a hand lever or a removable adjustable foot treadle having a stop. Single-phase alternating current is used and the capacity of the transformer is 16 kw. A ten-point self-contained regulator having an indicating dial at the side of the column is used to vary the voltage. The overhang of the machine is 36 in. and the die opening is 3 in. The distance between the horns is 8 in., and the hight from the floor to the center of the dies is 43½ in. The floor space required is 26 x 42 in. and the net weight of the welder is 2100 lb.

Adjustable Drafting Table.—A drafting table having both vertical and angular adjustments has been brought out by the New Britain Machine Company, New Britain, Conn. The board, which measures 36 x 48 in. and has a parallel attachment is secured to cast-iron brackets which in turn are pivoted to the vertical supporting members. The table is rigidly held in an angular position by tightening a hand lever which binds against a segment of the supporting bracket. Vertical adjustment is provided by a hand wheel.

Electric Light Accessories.—For use with its Magnalamp, which was illustrated in *The Iron Age*, April 18, 1912, the Sachs Laboratories, Inc., 103 Allyn street, Hartford, Conn., has brought out four new devices. These include the Magna clip, which can be used as a universal adjustment device, a reflector and an adjuster for regulating the hight of a flexible cord drop light. One or more of these devices can be used in conjunction on the same lamp. Another device is a counterbalance for vertically adjusting incandescent drop lights. This consists of a two-part insulating clamp which is attached to the flexible cord and also to a strong weight suspending cord which passes upward over a swivel and a fixed pulley on the ceiling to the counterbalance weight.

Open-Side Horizontal Spindle Milling Machine.—Several open-side horizontal-spindle milling machines of the face plate drive type have been recently built by the Ingersoll Milling Machine Company, Rockford, Ill. The bed and table are of the standard planer type construction and the latter has twelve feed changes together with a rapid power traverse in either direction at the rate of 30 ft. per min. All the driving and feed gears and the motor for driving the machine are assembled upon the main housing so that the machine can be entirely controlled from the working position. The saddle is an entirely new construction and has an in-and-out adjustment by hand with a micrometer stop for finer ones. This stop gives accurate adjustment for any position within the travel of the saddle so that cutters as large as 36 in. in diameter can be adjusted to a thousandth of an inch, just as easily as smaller cutters on a tool-room milling machine.

The Machinery Markets

The forecast that September will develop a heavy demand on manufacturers of machinery is amply supported by the excellent inquiries which are coming before the trade in every part of the country. New York has its share of promising inquiries to be added to business pending. Combined railroad and industrial requirements before the Chicago trade constitute a record aggregate and business exceeds that of early August. The New England trade, which reports August better than July and general demand good, has before it a list from the recently organized Vermont Machine Tool Company. Philadelphia has greater inquiry, although buying has not been heavy. Cincinnati has a good demand for power and pumping machinery and notes that railroad shops are working full time on repairs to rolling stock. The Cleveland demand holds up well and greater activity is indicated for this month. In Detroit August business turned out better than was expected and extensions to automobile plants are expected to enliven trade still more. St. Louis conditions continue good, with the call greatest for single tools and second-hand equipment. The Central South reports brisk business in boilers, electrical equipment and machine tools, and also that the railroads are busy in their repair departments. The demand in Birmingham for mill supplies continues active and the outlook is encouraging. In Texas the machinery industry is getting its share of the increased business which has resulted from good crop conditions. The market on the Pacific coast has taken a turn for the better, both railroads and other interests contributing to more spirited buying. Canadian development, particularly in the West, is unabated.

New York

NEW YORK, September 11, 1912.

An abundance of promising inquiries has been the most conspicuous feature of the past week in the New York market. While some houses selling direct found the early part of August somewhat slower in business actually consummated most of the dealers and several manufacturers' salesmen as well have enjoyed a scattered buying totaling a good figure. With several manufacturers and their representatives, deliveries, particularly of heavy machines, are now a cause of special solicitude for the reason that they are being urged to hasten delivery on orders placed some weeks ago. The deliveries specified were in every way satisfactory at the time of sale, but the greater activity in general manufacturing has caused buyers to want their new equipment at an earlier date than they previously thought necessary. Manufacturers of course are doing their best to accommodate their customers, and this again makes it more difficult to accommodate new buyers with quick deliveries. Excellent inquiries for forging machines are an indication of conditions as their purchase usually is a forerunner of other requirements for finishing operations. A good portion of the trade is actively interested in the recent lists of the New York, New Haven & Hartford Railroad and the General Electric Company. Though nothing definite as to time can be learned it is expected that lists will be issued at no very distant date by the Pennsylvania Railroad for its lines east of Pittsburgh and by the Baltimore & Ohio Railroad, as previously noted.

For the equipment of the machine shop on the battleship New York the Bureau of Supplies and Accounts of the Navy Department, Washington, is advertising, under schedule 4833, for the following machine tools to be delivered to the Brooklyn Navy Yard: High speed sensitive drill, motor driven radial drill, double emery grinder, portable boring machine, universal milling machine, screw cutting gap lathe, two motor driven tool room lathes and one tool room column shaper. Bids are to be opened at Washington October 8.

The plant of the Acme Road Machinery Company, Frankfort, N. Y., will soon be ready for the installation of the machinery required. A portion of such equipment has already been purchased and some of the remainder will be built in the company's own shops. It is stated, however, that a 72 x 12-ft. bed extra heavy iron planer is among the items still to be purchased.

The Matteawan-Mount Glenham Embroidery Company, Newburgh, N. Y., is completing a large addition to its factory building and increasing its equipment and manufacturing facilities.

Plans are being prepared by the Progressive Pulp & Paper Company and the Champlain Paper Company, Plattsburg, N. Y., for the construction and equipment of a power plant for joint use.

Contract has been awarded for the construction of a two-story addition, 50 x 60 ft., to be made to the plant of the Kingsboro Silk Mill, Gloversdale, N. Y.

The plant of the Janes Silk Mills Company, Paterson, N. J., is to be moved to Lackawanna City, N. Y., where a new factory building is being erected on South Park avenue by the Lackawanna Merchants' Association. A portion of the new mill is to be in operation in about two months. S. S. Farnham, 1010 Ridge avenue, Lackawanna City, is vice-president of the company.

Steps are being taken to rebuild the power plant of the International Pulp Company, Talcville, N. Y., which was recently destroyed by fire.

The Forbes Brass Company, manufacturer of plumbers' brass goods, Rochester, N. Y., is erecting a new plant in the Brighton district. The buildings will be of concrete construction and provided with the most modern foundry and finishing equipment. All machinery to be electrically driven. The company has also purchased and is now operating the foundry and plant of the Sterling Brass Works on Allen street.

The plant of the Cliff Paper Company in the lower milling district, Niagara Falls, N. Y., is to be greatly enlarged and modernized. A new five-story building, 60 x 100 ft., is to be erected and a story is to be added to the paper mill. The new building will be used for the manufacture of pulp. The entire plant is to be electrified for power and light. The cost of the improvements will be about $125,000.

The United Wax Paper Mfg. Company, Buffalo, has been incorporated with a capital stock of $25,000 and will establish a plant for the manufacture of waxed papers and bakers' goods containers. Henry J. Walz, Roswell S. Price and John E. Willis are the directors, with offices at 384 Michigan street.

The Pierce-Arrow Motor Car Company, Buffalo, has awarded a contract to the Aberthaw Construction Company, Boston, for the erection of three additional stories to its truck assembling building, 184 x 244 ft., and one additional story to each wing of its three-story body building, 60 x 402 ft. and 60 x 325 ft., respectively. Plans for the buildings were drawn by Lockwood, Greene & Co., Boston, architects and engineers. The buildings will be of reinforced concrete. Considerable new equipment will be installed.

New England

BOSTON, MASS., September 10, 1912.

The machinery dealers found August a better month than July and both produced a considerably larger volume of business than the same period of 1911. September is making a promising beginning. New England sees nothing but encouragement. Everything points to prosperity. A very noticeable improvement is seen in the textile business, both in woolens and cottons, and this condition is reflected conspicuously in the textile machinery industry, which is very much busier than it has been for some time. Indications are that coal will not be abnormally high here the coming winter. It had been feared that anthracite prices would be advanced sharply, which would be a hardship to manufacturers located in cities where smoke ordinances are strictly enforced. The trade schools are opening their sessions with a most encouraging enrolment of students.

This territory has been affected a good deal by the new demurrage rules recently put into force by the Interstate Commerce Commission and superseding State laws which were much more lenient to the shipper. The original change was to a flat 48-hr. limit, after which a daily penalty of $1 per car was fixed. The rule has been

modified so that the 48 hours shall not include time when cars are not approachable to vehicles because of weather conditions, and five hours are allowed for the receipt of a mailed notice of the arrival of a car. These changes are important in the New England climate. Still another important concession is a rebate of $1 a day for each car unloaded by the consignee on the first of the two "free days."

New England is interested in the meeting of builders of motor boats and marine engines, which will be held at the Ponchartrain Hotel, Detroit, next week with the purpose of discussing conditions as they affect these industries. The demand for small motor boats for pleasure purposes has fallen off materially, which is attributed to the low priced motor cars which have superseded boats in popularity. The boat and engine builders of the New England States are sufferers with their contemporaries of the Middle West, and have been invited to join in the conference. The demand for larger pleasure boats and for commercial boats is on the increase.

The Vermont Machine Tool Company, Windsor, Vt., is in the market for a considerable list of machine tools for its new shops. The company has recently been organized, with George O. Gridley as its head, to manufacture the Gridley automatic multiple spindle turret drill. It will occupy the building which was formerly the home of the Windsor Machine Company. The list of requirements follows:

Engine lathe for tool room, 16-in. swing, taper attachment, compound rest and draw back collet.
20-in. engine lathe, 12-ft. bed.
Screw machine for bar work up to 1 in. diameter.
Turret lathe for bar work up to 3-in. diameter by 24-in. length.
Sensitive drilling machine with two spindles, lever feed, Not. 2 Morse taper.
Radial drilling machine, plain, 3-ft. arm.
Key seating machine for pieces up to 12 in. diameter.
42-in. boring mill.
Gear-cutting machine, to handle up to 14-in. gears.
Milling machine, Milwaukee 3 B, with vertical attachment.
32-in. horizontal boring machine, Lucas.
Planing machine, 36 in. by 36 in. by 10 ft., with three heads.
Thread milling machine, 6 in. by 48 in.
Universal grinding machine, 12 in. by 30 in., with pump.
Plain cylindrical grinding machine, 18 in. by 96 in.
Cutting off machine capable of handling 8¼ in. diameter bar.

The Sanford Riley Stoker Company, Worcester, Mass., has been organized to manufacture an automatic stoker, the invention of R. Sanford Riley, recently president of the American Ship Windlass Company, Providence, R. I. Mr. Riley is the president and general manager of the new company, Aldus C. Higgins the treasurer, and George Jeppson the third director. The initial stoker is now in successful operation in the power plant of the Nararganseett Electric Light Company, Providence, R. I. Mr. Riley is well known in the stoker business, the American Ship Windlass Company having conducted an important department for the manufacture of this class of apparatus. He achieved marked success in the management of that company, building up the business to a profitable basis. He will return from Europe this month.

The E. Horton & Son Company, Windsor Locks, Conn., manufacturer of chucks, which is a consolidation of the business of the old company of the name and that of the S. E. Horton Machine Company, has consolidated its equipment in the main plant, at the same time materially increasing its manufacturing space and productive capacity. The factory of the S. E. Horton Company will be rented for manufacturing purposes

The Belcher & Taylor Agricultural Tool Company, Chicopee Falls, Mass., manufacturer of agricultural implements, is building a foundry to take the place of the structure recently destroyed by fire. The building will be of steel construction, 50 x 160 ft., and will be ready for occupancy in a few weeks. In the meanwhile the company is doing its molding in temporary quarters.

The C. H. Bartlett Mfg. Company, North New Portland, Me., manufacturer of wood turning novelties, will erect a mill 40 x 100 ft., two stories, to replace a structure which was burned recently. The company has been reorganized with new capital.

The Pawtucket Gas Company and the Pawtucket Electric Light Company, Pawtucket, R. I., and the Woonsocket Gas Company and the Woonsocket Electric Machine & Power Company, Woonsocket, R. I., are about to be merged into a corporation known as the Blackstone Valley Gas & Electric Company.

The Fales & Jenks Machine Company, Pawtucket, R. I., manufacturer of textile machinery and mill pumps, is erecting an addition to its shops which will give 26,000 sq. ft. of new floor space. The company states that no new equipment will be required at present, as the purpose of the addition is to permit the spreading out of existing machinery, relieving congestion.

The Edward Miller Company, Meriden, Conn., will erect a factory building 35 x 100 ft., five stories, of mill construction.

The various plants which were formerly operated by the new defunct Hardware & Woodenware Mfg. Company are starting up one at a time under new management, in some cases in control of the men who disposed of them to the combination. One such case is that of the Noble & Cooley factory at Granville, Mass., which is now owned by O. R. Noble and R. B. Cooley. The company manufactures drums, being, it is said, the largest house of the kind in the world.

The General Electric Company has taken out building permits for several additions to its River works at Lynn, Mass., comprising foundry building at the foot of Light street, 123 x 132 ft., two stories at the front; one at the rear, of brick with steel frame; an administration building 52 x 218 ft., four stories, of the same materials; a sub-office building 52 x 62 ft. and a transfer building 31 x 78 ft., of reinforced concrete.

The Gray Telephone Pay Station Company, Hartford, Conn., is asking bids for its factory, which will be 52 x 110 ft., four stories.

The plant of the Lombard Machine Company, Jamesville, Mass., has been purchased by James J. Rae, Yonkers, N. Y., who plans to manufacture on the premises a new carding machine of his own invention. He will continue the business of the Lombard Compay, which manufactures wool carding, feeding and picking machinery.

Frank J. Millea of the Enterprise Plating Company, Springfield, Mass., has purchased valuable mill privileges on the Scantic River at Hamden, Mass., including water power. The impression prevails in Springfield that the Enterprise Company will develop the property for its own purposes.

The Bridgeport Die & Machine Company, Bridgeport, Conn., has been organized to conduct a general machine business with rubber mold dies as a specialty, with a shop at 225 John street. James W. Ogden, the president of the company, was formerly superintendent of the Bridgeport Foundry & Machine Company, and associated with him is Elmer C. Ogden, recently foreman of the tool room of the Wolverine Motor Works. The initial equipment of the shop has been purchased.

W. A. & H. M. Curtis, Westminster, Mass., have purchased the plant and equipment of the Ashburnham Mfg. Company, Ashburnham, Mass., and propose to enlarge the business, manufacturing chairs under the name of the Curtis Chair Company.

The Royal Equipment Company, Bridgeport, Conn., will erect a factory building on Railroad avenue, 37 x 127 ft.

The Acme Shear Company, Bridgeport, Conn., will erect a foundry building 50 x 119 ft., one story.

Philadelphia

PHILADELPHIA, PA., September 10, 1912.

While there has been a trifle more inquiry for machinery and tools, actual transactions have not been particularly numerous. Conditions favor more active buying. The demand for special equipment stands out more prominently than for the standard types of machine tools. A trifle better demand for electric traveling cranes is noted. Railroad buying continues extremely small. Builders of machinery and tools, however, continue to make small gains in plant operations. A very fair demand for second-hand machinery and tool equipment is noted, particularly for the modern type of machine tools. A comparatively good volume of business is noted in boilers, but the engine trade remains quiet. Increasing activity is reported in all departments of the foundry trade.

The Chester Steel Casting Company, 407 Sansom street, Philadelphia, is in the market for a 10-ton and a 35-ton electric traveling crane, about 48-ft. span, with 6-ft. head room, for installation in its plant at Chester, Pa.

H. C. Eberle & Co., hosiery manufacturers, Third street and Cumberland avenue, is taking estimates for a new plant to be erected at Clearfield, Heppencott and A streets. The factory building will be 89 x 195 ft., four stories, of brick and steel. A power house, 25 x 73 ft., one story, will also be erected and necessary power equipment installed. The William Steele & Sons Company is engineer.

The Tacony File & Hardware Company, Tacony, Philadelphia, has been incorporated with a capital stock of $100,000. The Tacony File Works, 6744 Wissanoming street, has been operated for a long time by William Sheddinger.

The director of Public Works, Bureau of Water, city of Philadelphia, room 701 City Hall, will take proposals until September 17 for various appliances, including under contract No. 206 filter cleaning apparatus for the Belmont filter plant; contract No. 207, furnishing and setting metal doors at the same plant, and contract No. 209, steel sash for monitor at Torresdale pumping station.

Plans have been completed, it is stated, by Charles Balderston, architect and engineer, for a loft building, 100 x 400 ft., eight stories, at Broad and Wallace streets, to be known as the Metropolitan Building, in which George F. Lasher, 147 North Tenth street, is interested. Plans call for an extensive power plant equipment, elevators, steam heating, etc.

The Collins Carriage Works, Camden, N. J., has disposed of its plant to the Victor Talking Machine Company and will erect a reinforced concrete factory, 90 x 100 ft., three stories, on a site adjacent to its present plant. On completion of the new building the equipment now used will be removed to the new plant.

The United Roofing & Mfg. Company, Morris Building, has awarded a contract to W. W. Lindsay & Co., of this city, for the erection of its proposed new plant at Marcus Hook, Pa. Two buildings, one 60 x 200 ft. and one 43 x 160 ft., two and three stories, will be erected.

The trustees of the Eastern Pennsylvania State Institute for the Feeble Minded, at Spring City, Pa., will receive bids until September 18 for furnishing and constructing additional electric equipment, electric wiring, equipment for the machine shop and the installation of a plunger elevator. Plans and specifications may be obtained from Philip H. Johnson, architect, 1824 Land Title Building, Philadelphia.

John D. Adt, special machinery, Baltimore, Md., has acquired property 56 x 83 ft. adjoining the present plant. Two five-story buildings occupy the site, which will be used for manufacturing purposes. The first floors will be used as an erecting shop, permitting greater facilities in the present machine shop. Other portions will be used for warehouse purposes for machinery and supplies. No additional purchases of machine tools or power equipment are anticipated. This concern has recently shipped a quantity of special drying machinery for export to Manila, P. I., and has taken a number of orders for tobacco working machinery for both export and domestic shipment. Several orders for both electric and belt driven elevators have been received from local concerns.

The Alexander Milburn Company, manufacturer of acetylene lighting and oxy-acetylene welding apparatus, 502 Lombard street, Baltimore, Md., has acquired a four-story building at 1420-22-24-26-28 West Baltimore street, having a total area of 92 x 100 ft., which will be remodeled for manufacturing purposes. Electricity will be used for power. A special department will be fitted up for repair work by the oxy-acetylene welding process, and a considerable quantity of machine tools will be installed for manufacturing purposes. The company recently delivered a number of its welding outfits to a railroad repair shop in Pittsburgh, a structural steel plant in Washington and to other points in the South and West.

Chicago

CHICAGO, ILL., September 10, 1912.

The aggregate value of the machine tools for which inquiries are now pending in this market exceeds any similar total during a considerable period. Important railroad lists from the Elgin, Joliet & Eastern, the Chicago, Milwaukee & St. Paul, the Chicago & Alton, the Atchison, Topeka & Santa Fe and the Chicago, Rock Island & Pacific have been in the hands of machinery interests for figures for several weeks, while the Pennsylvania Lines West has just submitted a large list of requirements. The American Steel & Wire Company is obtaining prices on a preliminary list of machines preparatory to obtaining an appropriation. The list in its present form is not necessarily what will be purchased, but it represents a value of approximately $30,000, which is likely to be increased rather than otherwise. A northern Wisconsin concern is in the market for about $6,000 of tools, and it is understood that the machinery requirements of the two bolt nut and rivet plants to be built in the East Chicago district will be submitted for proposals in the near future. The last two weeks in August and the first week of September were productive of particularly satisfactory results as regards the volume of sales business, showing a decided improvement over the first part of August.

The Kottusch Patent Pulley Company, Chicago, has been incorporated with a capital stock of $75,000 to engage in the manufacture and sale of machinery. The incorporators are Emil W. Kottusch, G. C. Kliewer and Earl F. Gore.

The Page Boiler Company, 815 Larabee street, Chicago, has awarded the contract for a new shop, 14 x 91 ft., one story, to be built at an estimated cost of $8,000.

J. G. Karbatski, through John Duncan, architect, 60 West Washington street, Chicago, is preparing for the erection of a two-story machine shop, 25 x 115 ft., to cost $7,000.

The Chicago White Lead & Oil Company, Chicago, has purchased property at Fifteenth street and Western avenue, on which a plant will be erected. The main building is to be 100 x 250 ft and cost $21,000.

Sears, Roebuck & Co., Chicago, are engaged in the construction of three new fireproof buildings of which two will be for manufacturing purposes. The total investment contemplated will be approximately $1,000,000.

George F. Marchant, North Elizabeth street, Chicago, is preparing to build an addition, 100 x 125 ft., to his machine shop at a cost of $20,000.

The Victor Chemical Works, Chicago Heights, is building a new boiler room, 50 x 75 ft., one story, to accommodate additional power plant.

The Collis Company, Dubuque, Iowa, manufacturer of wire, hardware and machinery specialties, has arranged to move its plant to Clinton, Iowa.

The Hamilton-Beach Company, Racine, Wis., has purchased a site of three acres on which a new factory, 50 x 200 ft., two and three stories, will be erected at a cost of $25,000.

The Aero Shade Company, Waukesha, Wis., has begun the construction of a reinforced concrete manufacturing plant estimated to cost $20,000.

The Peteler Car Company, St. Paul, Minn., is making arrangements preliminary to the building of a new plant on a 23-acre tract recently acquired.

The G & J Tire Company, Indianapolis, Ind., is receiving bids covering the erection of a manufacturing building 80 x 170 ft., five stories, estimated to cost $100,000.

The M. Rumely Company, Laporte, Ind., is about to erect a boiler shop 120 x 260 ft. at its Battle Creek, Mich., plant. Figures are now being taken.

The Great Western Mfg. Company, Laporte, Ind., is having plans prepared for the erection of a two-story brick machine shop to be 190 ft. long.

Cleveland

CLEVELAND, OHIO, September 10, 1912.

The demand for machine tools is holding up well and the indications are that a good volume of business will come out during September. Dealers booked a satisfactory volume of orders in the week, these being mostly for single tools and small lots. A feature of the present condition of the market is that when inquiries are received from manufacturers these inquiries generally result in the placing of orders with little delay. Plants engaged in metal working lines are mostly well filled with orders, and, with future prospects bright, owners are not showing the hesitancy about buying additional equipment that they did early in the year. Considerable machinery will be required in this territory in the next two or three months for new plants and factory extensions. In the foundry trade conditions are unusually satisfactory. Jobbing foundries are crowded with work and buyers are having trouble in placing orders for castings for quick delivery. Reports from throughout the state indicate that foundries in other cities are well filled with work.

The plant of the United States Brass Company, Upper Sandusky, will be moved to Marysville, Ohio, and the company will be reorganized under a new name with a capital stock of $75,000. A brick factory building, 50 x 156 ft., will be erected. The company manufactures plumbers' brass goods.

The New Process Stove Company division of the American Stove Company, Cleveland, Ohio, will enlarge its plants by the erection of two new buildings. A one-story structure will be used for a japanning department and a new three-story building will be used for machine shop, annealing and storage.

The Easiest Way Mfg. Company, Sandusky, Ohio, has just established a plant for the manufacture of washing machines. J. F. Donohoe is manager.

The Patterson Foundry & Machine Company, East Liverpool, Ohio, is planning additions to its plant which include a three-story addition of reinforced concrete.

The extensions planned for the plant of the Standard Table Oil Cloth Company, near Girard, Ohio, include a machine shop and a two-story addition to the main plant. Steel, reinforced concrete and brick will be used in the construction.

The Council of Alliance, Ohio, has authorized the expenditure of $70,000 for the erection of a filtration plant and the erection of a waterworks standpipe.

The Automobile Electric Appliance Company, Cleveland, Ohio, has been incorporated with a capital stock of $20,000 by Paul S. Crampton, Charles R. Brown, Jr., and others.

The General Malleable Company, Warren, Ohio, has been incorporated with a capital stock of $20,000 by E. T. Ward, O. R. Grimmesey, George T. Fillius, S. B. Kistler and J. G. Gates.

The Standard Sales Company, 915 Hippodrome Building, Cleveland, announces that it has taken option on a site in Collinwood, east of the city, for a large plant for the manufacture of a new type of automobile tires.

The American Gas & Electric Company will shortly begin the erection of a new light and power plant at Newark, Ohio. This company has purchased the Thomas Foundry Company plant in that city for a site.

Cincinnati

CINCINNATI, OHIO, September 10, 1912.

The demand for power and pumping machinery from the larger railroad systems is very good, and it is also known that they are making many purchases of machine tools under cover. All railroad repair shops in this section are working on full time and several have on extra shifts in an endeavor to repair rolling stock before the crops begin to move. Manufacturers generally all admit that the West and Central West especially are now on the verge of the worst car shortage in the history of the country.

There is a slow but steady improvement with the jobbing foundries, and the second-hand machinery dealers are also making better reports.

Both the larger and smaller units of electrical equipment continue in excellent demand, and there are no indications that there will be any let-up in this particular business at any time soon.

In recent orders booked by the Laidlaw-Dunn-Gordon Company, Carthage-Cincinnati, are three air compressors and a large pumping engine for the Santa Fe System, two compressors for the Illinois Central Railroad, two for the Southern Railway, three for the New York Central Lines and one each for the Pennsylvania and St. Paul, Minneapolis & Omaha Railroads. The company is also building a large Corliss flywheel pumping engine for hydraulic pressure, to be shipped to the East End Power Company, New Glasgow, Nova Scotia.

One story of the Stewart Iron Company's new auto-truck factory, in Covington, Ky., has been completed, and the company expects to have the plant in full operation before January 1. The machine tool list has not yet been made up, but will probably be ready for bids within the next 30 days.

The Union Distilling Company, Cincinnati, has let contract to the Allyn Company for a seven-story brick warehouse addition to be made to its plant on Carthage pike. Considerable heating equipment will be required for the proposed building.

A small electric lighting plant will be erected by the New Knoxville Electric Company, New Knoxville, Ohio, recently incorporated with $8,000 capital stock. B. E. Cook and James Slack are named among the incorporators.

The Bessemer Gas Engine Company has moved its Cincinnati sales office from the First National Bank Building to 234 West Fourth avenue, where it will carry in stock a complete line of gas engines of its manufacture. P. C. Benedict is sales manager.

The Automatic Coin Cashier Company, Hamilton, Ohio, has been incorporated with $10,000 capital stock to manufacture a coin changing device. Joseph F. Hibner and W. H. Ringer are interested in the new company.

The J. & F. Schroth Packing Company, Cincinnati, has let contract for remodeling its refrigerating plant in the Camp Washington district and will require some new equipment.

The Ohio Knife Company, Cincinnati, has commissioned B. L. Baldwin & Co., Cincinnati architects, to prepare plans for a manufacturing plant to be erected in South Cumminsville suburb. The company's present factory at Ninth and Maclean streets will be removed to the new location and considerable extra equipment will be required. The company makes a specialty of woodworking machinery knives.

The proposed addition of the Sterling Cut Glass Company, Cincinnati, recently mentioned, will be 50 x 165 ft., two stories. Only a small amount of transmission and power equipment will be required.

The three-story addition to the plant of the Eagle White Lead Company, Cincinnati, is now well under way, and the company expects to occupy it before the winter season opens.

The Allyn Company, Cincinnati, will soon be ready for bids for the boilers and other heating equipment required for a five-story Masonic Temple building to be erected at Lexington, Ky.

Samuel Hannaford & Sons, Cincinnati, will receive bids until October 8 for the following equipment necessary to fit up the Cincinnati General Hospital buildings now under construction: A refrigerating and cold storage plant, boilers, engines and generators, sterilizing outfits, elevators, etc.

Detroit

DETROIT, MICH., September 10, 1912.

August has been a more satisfactory month for most dealers than was anticipated and with the fall business beginning to come in the outlook for increasing activity is favorable. A fair amount of business developed in the past week and inquiries for small lots of metal-working tools are quite numerous. This is the dull season in the automobile trade, but in consequence of the extensive additions which are being made to some of the local plants, machinery sellers are looking for considerable buying from this source in the near future. The automobile accessory makers are actively engaged and have been in the market considerably of late. The market for woodworking equipment is less active, but this is believed to be only a temporary lull. Some improvement is shown in the second-hand machinery market. Building conditions are more active and a good demand for heating and ventilating equipment, elevators, etc., is reported.

The Northway Motor & Mfg. Company, Detroit, is preparing to double its capacity and to this end has awarded a contract to the Hunkin-Conkey Construction Company, Cleveland, for the erection of five new buildings of brick and mill construction.

On petition of creditors the King Motor Car Company, Detroit, has been declared bankrupt and the Union Trust Company named as receiver. The plant will not be operated for the present.

The Welded Steel Barrel Corporation, Detroit, has purchased two acres of land at Charlevoix street and the outer belt line and will erect a new factory, 80 x 300 ft., of reinforced concrete construction.

The Kelsey Wheel Company, Detroit, manufacturer of automobile wheels, has filed notice of an increase of capital stock from $500,000 to $1,000,000.

The Hayes Mfg. Company, Detroit, maker of auto parts, has increased its capital stock from $500,000 to $750,000 to provide for additional working capital.

The Traveler Motor Car Company, Detroit, has been incorporated with $15,000 capital stock to manufacture automobiles and accessories. The incorporators are William J. McIntyre, Joseph P. Lavigne and William L. Kenfield.

The Motor Patents Company, Detroit, has been incorporated with $10,000 capital stock to manufacture machinery and mechanical devices. The incorporators are John W. Dyar, Sherman L. Depew and Earl W. McGookin.

The Detroit Corrugated Board & Box Company, Detroit, with $10,000 capital stock, has been organized by Louis, Joseph M. and Melville S. Welt to engage in the manufacture of corrugated board containers.

Lonyo Bros., Inc., Detroit, has been organized with $15,000 capital stock to operate a brick plant. Albert Lonyo is the principal stockholder.

The International Heat Products Company, Pontiac, Mich., has changed its name to the Peninsular Steel Castings Company.

The Piston Ring Company, Muskegon, Mich., manufacturer of automobile parts, has increased its capital stock from $5,000 to $13,000.

The Sterling Motor Company, Flint, Mich., has been incorporated with $300,000 capital stock by W. C. Durant and associates. The company is arranging to acquire and equip a plant for the manufacture of automobile engines.

The Muskegon Steel Castings Company, Muskegon, Mich., has filed a voluntary petition in bankruptcy, and Edward S. Lyman, of Muskegon, has been named as receiver.

The artificial ice plant of the Cushman & Schermerhorn Company, Sturgis, Mich., was destroyed by fire September 1, entailing a loss of $15,000.

The Nichols & Shepherd Company, Battle Creek, manufacturer of agricultural machinery, is preparing to erect extensive additions to its plant. The new buildings include a foundry building, 205 x 230 ft.; an addition to the separator department, 25 x 160 ft., and a paint shop. Complete new foundry equipment will be installed.

The Council of Big Rapids, Mich., has approved the expenditure of $50,000 for rebuilding and extending the waterworks system and the taxpayers will vote on the question September 17.

The Wizard Mfg. Company, St. Joseph, Mich., has been incorporated with $10,000 capital stock to manufacture carburetors. The stockholders are Frank A. Sharpneck and Thomas Robinson, Chicago, and Gerald C. McDowell, St. Joseph.

The Hess-Pontiac Spring & Axle Company, Pontiac, maker of automobile springs, will build an addition, 62 x 154 ft., which, with the addition now being completed, will double its present manufacturing capacity.

The Pontiac Auto Castings Company, Pontiac, Mich., which was recently incorporated, has purchased a five-acre site and awarded a contract for the erection of a one-story factory building, 40 x 100 ft. The company will specialize in brass and aluminum castings.

The village of Lawrence, Mich., will install a new gas lighting system to replace the plant destroyed by fire last spring.

The Wagemaker Furniture Company, Ltd., Grand Rapids, Mich., has been reorganized under the style of the Wagemaker Company and enlarged its capital stock from $40,000 to $100,000 to increase its facilities.

The United States Robe Company, Corunna, Mich., is planning to increase its mechanical equipment. W. J. Simeon is president.

The Union Brass Works, Detroit, has increased its capital stock from $30,000 to $70,000.

The Eastern Edison Company has purchased a tract of land on the west bank of the River Rouge near Fort street, Detroit, upon which it is erecting a large brick and cement building which will be used as a transformer station for supplying power and lights.

It is reported that the plant of the Peninsular Motor Company, a subsidiary of the General Motors, located at Saginaw, Mich., will be moved to Flint. The plant at Saginaw is closed at present.

The Eagle Tanning Company, Whitehall, Mich., has begun work on a large addition to its local plant.

The Central South

LOUISVILLE, KY., September 10, 1912.

Business has been fairly good. Manufacturing operations in this territory are picking up appreciably, a condition which favors activity in the machinery business. The railroads are busy in their repair departments, and this has stimulated the demand from that quarter. Building construction is going ahead apace and is supplying a good deal of business as heretofore. While a seasonable dullness is reported in the case of certain specialties, general lines such as boilers, electrical equipment and machine tools are in brisk demand.

The National Association of Master Bakers held its annual convention in Louisville last week, one of the features being an exhibition of machinery in the First Regiment Armory. While practically all the exhibits were of special value to the bakers, they furnished an interesting display for the general observer. The Thomson Machine Company, Belleville, N. J., showed a motor-driven molder; the American Bakers Machinery Company, St. Louis, a full line of bakers' equipment, and the American Blower Company, Detroit, the American Oven & Machine Company, Chicago, and the Reeves Pulley Company, Columbus, Ind., transmission machinery, were others among the exhibitors with good displays.

The Louisville & Nashville Railroad Company has purchased six Allis-Chalmers motors, from 15 to 40 h.p., for use in its South Louisville shops. The machinery there is now operated by three 350-kw. generators and 40 motors, all of Allis-Chalmers manufacture.

E. D. Morton & Co., Louisville, machinery dealers, report sales of a Robbins conveyor to the Louisville Railway Company for use in its coal-handling work; a gap lathe of the Barnes Drill Company, Rockford, Ill., to J. Schwarzwalder & Sons, Louisville, and a 100-ton Howe truck scale to Wright & Taylor, Louisville distillers.

G. W. Binder has been appointed superintendent of the plant of the Universal Swing Joint & Machine Company, Louisville, which succeeded the Kentucky Gear & Machine Works. Several machine tools will be bought, the orders not yet having been placed.

A small fire at the plant of the American Machine Company, Louisville, September 5, caused $500 damage.

The flour mill of McLean & Moore, Pleasant Valley, Ky., was burned recently with $12,000 loss. The company plans to rebuild in the immediate future.

The Bluegrass Condensed Milk Company, Louisville, Ky., is considering the installation of a plant at Elizabethtown, Ky. The company will invest $60,000. R. F. Wortham and H. G. Carter are interested. Power and refrigerating equipment will be needed.

The Wedgerite Power Company, Shelbyville, Ky., has been incorporated with $25,000 capital stock by Albert Scott, A. J. Dietzmann and J. C. Armstrong, of Louisville, and plans to erect a plant to manufacture a patented explosive.

The Mansard Hotel, Bowling Green, Ky., has announced plans for improvements to cost $40,000. A steam heating plant will be installed and elevators will be purchased.

H. M. Runyon is reported to be planning the establishment of a chair factory at Ashland, Ky.

The Hardy Buggy Company, Paducah, Ky., the plant of which was partly destroyed by fire several months ago, is considering rebuilding at Waco, Tex.

J. W. Mann and C. A. Taylor, Concord, Ky., will erect a flour mill with a capacity of 150 barrels a day.

The Central Automobile Company, Newport, Ky., is erecting an automobile repair shop. Walter P. Dickerson is president of the company. The orders for much of the machinery have been placed.

F. L. Clore & Son, Henderson, Ky., who operate a sawmill, will remove the mill to Fayette, Ala., in the near future and add some additional equipment. A 10-ton crane is one of the items needed.

A steam heating plant of considerable capacity will be installed at Crab Orchard Springs Hotel, Crab Orchard, Ky.

R. E. O'Flynn & Co., Owensboro, Ky., will install a tobacco redrying plant at Glasgow, Ky. Boilers will be needed for this plant.

The United Gas & Electric Company, New Albany, Ind., is considering the installation of additional equipment and the extension of its lines to a number of communities in Southern Indiana. Samuel Insull, Chicago, is president of the company.

The Advance Power Company, Chicago, is negotiating for the plant of the American Automobile Corporation, New Albany, Ind. The former concern manufactures motor cars and plans to use the New Albany plant as well as that in Chicago if the deal goes through.

Puryear, Tenn., is planning the installation of a small municipal electric light and power plant. A water plant will be operated in connection with it.

W. M. Janes, Paducah, Ky., and others have secured control of a phosphate tract near Centreville, Tenn., and will install a large plant.

The Tennessee Improved Cotton Gin Company, Jackson, Tenn., has been formed with $20,000 capital stock to manufacture ginning machinery. P. Rand, L. N. Hine and others are stockholders.

The United States Feed & Grain Company, Memphis, Tenn., has been organized to erect a grain elevator. The machinery will be electrically operated. C. O. Ramer is secretary and treasurer.

L. H. Phetteplace and others are reported to be planning the establishment of a furniture factory at Erwin, Tenn.

The Commercial Club of Franklin, Tenn., has the details of plans for a large hosiery mill which it is intended to establish there.

The Mountain City Stove & Mfg. Company, Chattanooga, Tenn., has taken over the Queen Range Mfg. Company, Chattanooga, the effects of which were disposed of at a receiver's sale. The Mountain City Company plans the erection of a new plant for the manufacture of the Queen line of stoves and ranges.

The Chattanooga Cold Storage & Warehouse Company has been incorporated with $50,000 capital stock by Theodore F. King and others. A building has been leased and will be equipped with refrigerating machinery.

The Corinth Auto Company, Corinth, Miss., is in the market for machine tools for its repair shop, including a lathe, drill and milling machine.

The Southern Tool & Supply Company has been organized in Chattanooga, Tenn., with $25,000 capital stock by J. W. Gore, Kelly O'Rear and others.

The Modern Tiling Mfg. Company has been incorporated in Knoxville, Tenn., with $100,000 capital stock and will build a large plant for the manufacture of tiling. A. S. J. Davis is president and treasurer and R. A. Mouran secretary and general manager.

The Business Men's League, Booneville, Miss., is interested in the installation of a waterworks system and electric light plant there, and is investigating the proposition. A. J. McIntyre is president of the league.

The Tracy Lumber Company, Gatesville, Miss., will erect a sawmill near Hattiesburg, Miss.

O. H. Vial, Bristol, Va.-Tenn., has begun the construction of a large band mill at Waynesville, Va. A 20-mile railroad will be built to the property.

Birmingham

BIRMINGHAM, ALA., September 9, 1912.

Everything in the machinery line has been looking up since the middle of August and present business is satisfactory with the same good prospect ahead of increasing purchases owing to more extensive operations by machinery and machine tool users. The principal demand right now is from the sawmill trade. The mills are all busy and are in the market for pumps, engines and boilers. The coal mines are in the market also with a special demand for pumps. The repair trade is excellent and the business in small goods is also up to expectations. As a general proposition it may be said that the southern machinery business is in good form with just as good prospects. There was a slight lull the first ten days of August, but that has been overcome by good business actually going on and inquiries that foreshadow a good business to come.

A box factory will be established at Jacksonville, Fla., by W. A. and J. R. Jackson, of Boston, Mass.

The Birmingham Box & Veneer Company, Birmingham, has been incorporated with a capital stock of $16,000. E. T. Douglass is president and J. N. Cornelius is secretary and treasurer.

Application has been made for a charter for the Armuchee Cooperage Company, Armuchee, Ga., by J. R. Brown, H. F. Brown and J. R. Raible, all of Gadsden, Ala. The capital stock is $10,000, with privilege to increase to $20,000.

The Consumers' Ice & Cold Storage Company, Key West, Fla., will increase the capacity of its plant to 100 tons a day. It will install two triplex brass-fitted water pumps with capacity of 1000 gal. per minute, two electric hoisting cranes with lifting power of 800 lb. each, 125-kw. direct electrical generator, etc.

The Peacock Iron Works, Selma, Ala., will probably establish a plant to manufacture cars and car wheels at Attalla, Ala., on a 20-acre site donated by W. F. Stowers. Local citizens have subscribed $20,000.

Meigs, Ga., will receive bids to September 17 for the installation of an electric lighting plant.

Architect Walter G. Frantz, of Cincinnati, has prepared plans for an electric lighting plant for the Tuskegee Institute, Tuskegee, Ala.

The Lawrenceville Oil Mills, Lawrence, Ga., has been incorporated with a capital stock of $24,000. W. A. Cooper, G. W. Clower and associates are interested.

J. W. Wilder will establish a sawmill on Shingle Creek near Kissimee, Fla.

B. B. Comer and associates, owners of the Avondale Cotton Mills, have decided to erect a $700,000 mill at Sylacauga, Ala., after investigating a number of sites.

St. Louis

ST. LOUIS, MO., September 9, 1912.

Business in the local machine tool market continues to maintain its favorable aspect and the aggregate remains good, although no large lists are being presented. Most of the business comes from single tool requests and the second-hand division is showing up well. Prospects for the future are considered most satisfactory. Collections continue excellent.

The Hudson-Phillips Motor Car Company, the local branch of the Hudson Company, has leased large new quarters and will install a complete repair department in addition to the storage space.

The Engine Starter Company, St. Louis, with $50,000 capital stock, has been organized by George W. Owens, Louis H. Mesker, Fred G. Decker and others to equip a plant for the manufacture of a newly patented self-starting device for automobiles.

The Newport Warehouse & Terminal Company, St. Louis, has been incorporated by W. H. Redemyer, Edgar Littmann, John D. Manley, H. A. Lueking, W. A. Miller, W. F. Goessling, Frederick J. Benner and L. J. Downs, to establish warehouses and operate terminal facilities with extensive mechanical equipment.

Fire destroyed the elevator at Bridgeton, Mo., of the Schultz & Niemeier Commission Company, St. Louis, September 4, with a loss of $100,000. The elevator with its equipment will be replaced at once.

T. M. Sayman, St. Louis, has completed plans for the construction and equipment of an eight-story fireproof building for soap manufacturing. The building and equipment will cost $350,000.

The Hannibal Gas Machine & Mfg. Company, Hannibal, Mo., with $10,000 capital stock, has been organized by Charles M. and Frank Kruger and Max Sendig and will equip a plant for the manufacture of gas appliances.

The Wingfield Mining Company, Webb City, Mo., has increased its capital stock to $32,000 and will install mining equipment on its property at once.

The Athletic Mining Company, Webb City, Mo., has increased its capital stock from $50,000 to $64,000 for the purpose of putting in additional mining equipment and extending its operations.

The Knapp Automatic Coupler Company, St. Louis, previously reported, has completed incorporation with $35,000 capital stock and will equip a plant for manufacturing air couplers. George N. and J. R. Knapp and L. S. Crossman are the stockholders.

The Carondelet Packing Company, St. Louis, has increased its capital stock from $40,000 to $60,000 for the purpose of enlarging its mechanical equipment.

The issue of $12,000 bonds by the city of Fredericktown, Mo., for an electric light plant has been confirmed and the mayor is now seeking bids.

The city of Sheldon, Mo., has under consideration the construction of an electric light plant under municipal ownership.

The Scott Drill Company, St. Louis, with $500,000 capital stock, has been incorporated by Frank Wyman as president, Lewis L. Scott as vice-president and John R. Williams as treasurer, and will equip a plant for the manufacture of power drills.

The vote of $75,000 of bonds for sewage and waterworks plant at Kennett, Mo., has been legally confirmed and work is planned early this fall.

Under a $16,500 bond issue the city of Doniphan, Mo., has completed plans for the increase of its waterworks service and plant.

The Merchants' Lighting Company, Little Rock, Ark., has been incorporated with $400,000 capital stock by Edward Cornish, Christopher Ledwidge, C. E. Ross and others and will equip a plant with about 2000 kw. generating equipment, 1800 h.p. in boilers and other necessary machinery.

The Southern Petroleum Company, Pine Bluff, Ark., has been organized with $50,000 capital stock by H. B. Strange, F. M. Smarts and G. S. Linn to develop oil property owned by the company.

The city authorities of Lambert, Miss., are in the market for additional waterworks equipment.

The Mannford Oil & Gas Company, Mannford, Okla., has been incorporated with $50,000 capital stock by H. U. Bartlett and Theo. G. Lashley to develop oil property owned by the stockholders.

The Tecumseh Broom Company, Tecumseh, Okla., recently incorporated, is in the market for considerable equipment, including power winders, burl cutters, etc.

State Penitentiary Warden R. W. Dick, of Oklahoma City, Okla., is taking up the matter of the equipment of a twine manufacturing plant.

Water, light and ice plants are to be constructed at Texhoma, Okla., at a cost of about $50,000 by J. W. McRea and others of Amarillo, Texas.

A cannery with 75,000 to 100,000 cans daily capacity is to be built and equipped at Wood, La., by L. M. Fairbanks, of Mansfield, Ill. A factory to manufacture boxes and crates will also be equipped.

J. E. Rutledge of St. Louis and Fred B. Lynch and Albert J. Nason of St. Paul, Minn., have purchased coal land in Illinois near Nokomis estimated to contain about 25,000,000 tons and will equip it for operation at once. The Chicago & Eastern Illinois Railroad is building a line to the tract. The Nokomis Coal Company, capital $300,000, will be the operating concern.

Preliminary work on the construction of the St. Louis & Western Traction Company, to run from St. Louis to Valley Park, Manchester and Ballwin; under the direction of J. D. Houseman of St. Louis, has been begun. The road will build and equip its own power house.

Twenty-year franchises for gas, electric lighting and public heating in University City, Mo., a suburb of St. Louis, have been formally granted to the Regents' Publishing & Mercantile Company, which recently purchased the buildings and plant of the Lewis Publishing Company.

The Christopher & Simpson Architectural Iron & Foundry Company, St. Louis, has increased its capital from $200,000 to $250,000 for the purpose of enlarging its plant, etc.

The Continental Radiator Company, St. Louis, has increased its capital from $50,000 to $300,000 for the purpose of enlarging its manufacturing operations as recently reported.

The Gardner Governor Company, Quincy, Ill., with $1,500,000 capital stock, has received permission to utilize $50,000 thereof in manufacturing operations in LaGrange, Mo.

The city of Lake Providence, La., recently reported as planning public utilities extension, will receive bids until September 24 for additional machinery for the municipal electric lighting plant, also waterworks machinery and boilers and pumps.

A new engine house is to be built by the St. Louis fire department at Ninth and Buchanan streets, Fire Chief C. E. Swingley in charge. Automobile fire apparatus is to be bought therefor.

The H. T. Brown Company, Little Rock, Ark., has been organized with $10,000 capital stock by H. T. Brown, W. L. Connevey and C. F. Cunningham to equip a plant for the manufacture of staves and headings.

The Quinn & Atkins Journal Jack Attachment Company, Shreveport, La., has been incorporated with $150,000 capital stock, by J. W. Atkins, W. E. Quinn and others to equip a manufacturing plant for their device.

The Oronogo Circle Mining Company, Joplin, Mo., has completed plans for the installation of electrical drive equipment to the amount of 900 hp. Seventeen motors, compressors, hoists, etc., are included in the machinery required.

The organization of the Carruth Bros. Lumber Company has been completed at Coral, Miss., by J. S. and C. F. Carruth and E. A. Thomas with $100,000 capital stock. A sawmill and woodworking plant will be equipped.

Plans for the installation of an electric light plant in connection with the waterworks are under contemplation by the municipal authorities of Sardis, Miss.

A franchise has been granted by the city of Williamstown, Ky., to J. E. Shoop, of the Williamstown Electric Light Company, to build and equip an electric light plant.

The contract for a bridge to cross the Arkansas River at Pine Bluff, Ark., as a cost of $605,000 has been awarded by the county officers to the Roemheld Construction Company, Chicago.

The Leader Pipe Line Company, Casey, Ill., has been organized with $10 000 capital stock by J. B. and H. B. Phillips and C. C. Allen to build and equip an oil pumping line.

The Forest Park Brewing Company, St. Louis, has increased its capital from $100,000 to $200,000 for the purpose of increasing its equipment.

Texas

AUSTIN, TEXAS, September 7, 1912.

If current estimates prove correct the cotton crop will be the largest in the history of the State. Cotton is our money crop and all lines of industry are benefited when the yield is large and prices are good. The increasing machinery trade is a reflection of the general prosperity that prevails.

The Farmers' Gin Company, which has been organized at Beichley, will install a cotton gin; incorporators, F. A. Capps, R. H. Seale and J. B. Dunn.

The Farmers' Union Gin Company, Oglesby, will build a cotton gin; incorporators, F. Boyd, F. B. Lam, M. E. Burleson and others.

The City Council of El Paso has under consideration a proposition to submit to a vote of the taxpayers a bond issue of $350,000, the proceeds to be used for extending the sewer system, the erection of a new high school building and other municipal improvements.

The Corsicana Brick Company, Corsicana, with a capital stock of $50,000, will erect a brick-making plant; incorporators, C. A. Benton, Cal W. Kerr and Hilton Hill.

The Teague Cotton Oil Mill Company, Teague, has been organized with a capital stock of $40,000; incorporators, H. B. Alexander, A. B. Foster and George B. Barber.

The Gates Handle Company, Louisville, Ky., will install a plant at Beaumont for making wooden handles. It will also erect roughing plants at Nacogdoches, Lufkin and Timpson, near the timber supply, to rough out the handles which will be shipped to Beaumont for finishing.

The City Commission of Dallas has awarded the contract for the installation of a water filtration and purification plant to the American Water Softener Company, Philadelphia, for $201,674. The specifications were prepared by James H. Fuertes, of New York City. It is expected that the plant will be finished by May 1, 1913.

The Mexia Oil & Gas Company will lay a natural gas pipe line from its well near Mexia to the city and will construct an extensive gas distributing system there.

Charles P. Taft, of Cincinnati, who owns the 160,000-acre ranch on which the town of Portland is situated, has begun the installation there of a waterworks plant and the construction of a distributing system that will cost approximately $100,000. The water will be brought from the town of Taft, situated 11 miles north of Sinton. Mr. Taft is also arranging to make other extensive improvements to the town.

The Garwood Irrigation Company, Garwood, which has a capital stock of $100,000, will enlarge its pumping plant and make other improvements. The new plant will be three times larger than the present one. G. M. Jackson is general manager.

J. E. Franklin, president of the Bankers' Trust Company, St. Louis, is preparing to construct a large system of irrigation near Crystal City, with a view of watering 10,000 acres of land that he owns.

D. D. Sipllane, San Luis Potosi, Mexico, who recently obtained a concession to install a hydroelectric plant at the junction of the Maria and Fallinas rivers, has organized a company in the United States for the purpose of carrying out the project. It is claimed that the normal flow is capable of developing 40,000 h.p. Surveys have been made for proposed water storage reservoirs by which the available horsepower may be increased to 100,000. Transmission lines will be constructed from the plant to the cities of San Luis Potosi, Tampico, Saltillo, Matehuala and a number of other towns and industrial centers in that part of Mexico.

The El Paso Milling Company, El Paso, has finished the installation of the first two units of its large woodworking plant and is now producing 150,000 ft. of finished products daily. When finished the plant will have cost approximately $1,000,000. It will manufacture box shucks, cut sash and door stock, bevel sidings, moldings, interior trim, lath, ceilings, wainscotings, floorings and other kinds of finished lumber used in building construction. It is said that the plant will be the largest of its kind in the country.

The Transcontinental Petroleum Company, Tampico, Mexico, which was recently granted a highly favorable concession by the Mexican Government, is

preparing to lay an extensive system of oil pipe lines in the states of Verra Cruz, Hidalgo and Tamaulipas, in connection with which it will install a number of oil pumping plants. Under the terms of the concession the company is permitted to import the material for its pipe lines and pumping stations free of duty.

An appropriation of $10,000 has been voted by Yucatan, Mexico, to be offered as a prize to the engineer or contractor who submits the best plans or suggestions for a modern waterworks system for Merida. The competition is open to Americans as well as to all other nationalities.

The department of public works of the federal government of Mexico has ordered the installation of a hydraulic pump and other improvements to the waterworks plant for the town of Tlalpam, a suburb of Mexico City.

It is announced by Felix Adler & Co., who obtained a concession several months ago for the construction of a system of oil pipe lines in the state of Vera Cruz, Mexico, that they are now making contracts with oil producers and the work of laying the lines will soon be started.

The Pacific Coast

SAN FRANCISCO, CAL., September 3, 1912.

The machine tool market has taken a sudden turn for the better, and the situation offers more encouragement than for many months. Railroad inquiries are turning out above expectations, and sales have been made on a few small lists for other interests, while a number of single tools of large capacity have been sold.

Just at present attention is focused on the list issued by the Western Pacific Railroad for its Jeffrey shops, which is the largest list of tools to appear on the coast for several years. It includes equipment for machine and boiler shops, planing mill, wheel shop, power house and blacksmith shop. Among the principal items are 10 lathes, 16 to 42 in.; two large planers; two 5-ft. radial drills; a 90-in. boring and turning mill; three 24-in. shapers; an 18-in. slotter; a No. 3 universal milling machine; three 42-in. drill presses; a double punch and shear, 48-in. throats; a horizontal punch; a 42-in. steel tire carwheel lathe; a 3300-lb. hammer; a large compressor and a 225-h.p. Scotch marine boiler.

The Southern Pacific Railroad has also come out with a list of tools amounting to $30,000 to $40,000, to be installed in its Oregon shops, and is taking preliminary figures on a lot of tools which are supposed to be for a shop in Arizona.

The Pacific Gas & Electric Company has placed orders for a 30-in. Bickford radial drill, a 20-in. Stockbridge shaper, a 16-in. x 10-ft. Niles & Shipley lathe and a 24-in. Aurora drill.

The Petaluma & Santa Rosa Railway has ordered a 42-in. Niles carwheel borer.

The United States Steel Products Company has installed in its local warehouse a guillotine bar shear.

The Union Iron Works has purchased a No. 4 Hilles & Jones bending roll, 10 ft. wide, with motor drive.

The Aurora Engine Company, Stockton, Cal., has ordered a 42 x 30-in. x 12-ft. planer.

Dealers in oil well machinery report a material increase in the demand, having made some good-sized sales of drilling outfits, air compressors, etc.

The property and patents purchased some time ago from the Johnson Tractor Company by the Joshua Hendy Iron Works, this city, have been sold to the Rumley Mfg. Company, LaPorte, Ind. The traction engines, however, will be manufactured as before by the Hendy plant, Sunnyvale, Cal.

George W. Hess, representing the Sivyer Steel Casting Company, Milwaukee, Wis., and a number of other manufacturers of contractors' machinery, has opened an office at 903 Monadnock Building, this city.

The city of Los Angeles will take bids September 17 for two 250 h.p. boilers, a pumping engine and a duplex cross-compound air compressor.

Construction has been started on a two-story brick and steel building for the San Diego Electric Railway Company's car and machine shop, San Diego, Cal.

A municipal machine shop is proposed for the city of Sacramento, Cal.

A report recently circulated that the Llewellyn Iron Works, Los Angeles, would establish a plant on the old Sumner tannery site at Benicia, Cal., is found to be untrue. The old tannery machinery has been purchased by the Buckley Wrecking Company, this city.

It is reported that the Pacific Portland Cement Company, which recently purchased a railroad from Auburn, Cal., to a lime quarry near Cool, will soon install a machine shop at Auburn. Two locomotives have been purchased recently and more will probably be ordered within the next year.

The city of Palo Alto, Cal., will take bids September 23 for a condensing plant and generator set for the municipal power plant.

The Westinghouse Pacific Coast Brake Company has purchased additional land for its Oakland plant, giving it almost an entire block bounded by Park avenue, Halleck and Hubbard streets and the Santa Fe Railroad.

A. A. Hilton, for eight years Western manager for the Griffin Wheel Company, with headquarters at Tacoma, Wash., has purchased the interest of the Hofius estate in the Hofius Steel & Equipment Company, Seattle, Wash., and has been elected president of the company. George Danz and W. W. Williams remain as vice-president and secretary respectively.

It is reported that the American Smelting & Refining Company, counting on the increase in the Alaska copper output, will practically rebuild its Tacoma, Wash., plant during the coming year, at a cost of about $300,000. New flues will be installed and a steel building 300 ft. long erected.

The J. D. Adams Company, Indianapolis, Ind., manufacturer of road machinery, have established an office in Portland under the management of S. D. Kiger.

Western Canada

WINNIPEG, MAN., September 6, 1912.

There is a very healthy feeling in local machinery circles. The different houses are busy attending to orders recently received, and the inquiry keeps up fairly actively. The volume of business so far in 1912 has exceeded expectations. There has been a gratifying movement of most kinds of machinery, but especially the kinds used in flour mills, lumber mills, grain elevators, waterworks, etc. Although it is now drawing near the winter season, there seems to be little or no falling off in the number of announcements of new industries and plant improvements. The outlook is better than at the corresponding period in any previous year in this new country. The city of Edmonton, Alberta, is inaugurating a strong campaign to induce manufacturing industries to locate there. Special stress is being laid on the comparatively cheap fuel there, the district having immense undeveloped coal beds. George M. Hall, formerly of Winnipeg, has been appointed industrial commissioner and he will be closely in touch with any new industries contemplating starting in that city.

Recent developments at Vancouver, B. C., in connection with the British Columbia Electric Railway indicate that the plant of the Western Canada Power Company, Ltd., of which R. G. Hayward is the general manager, will have to be enlarged.

John F. Hansen, Winnipeg, who is a director in three large prairie land companies, is conducting negotiations at Vancouver to organize a company to erect car works at Port Mann, B. C. It is understood that McKenzie & Mann, of the Canadian Northern Railway, are interested in the proposition.

The Rogers Lumber Yards, Ltd., of Moose Jaw, Sask., has been incorporated with a capital stock of $2,000,000 to carry on a general lumbering business, and it is likely that the company will erect some lumber mills in the West.

The citizens of Humboldt, Sask., have voted favorably on a bylaw to spend $30,000 on an electric light plant.

The citizens of MacLeod, Alberta, have voted favorably on a bylaw to spend $81,000 on a filtration plant.

The Rock Creek Land Company, Ltd., Midway, B. C., has been incorporated with a capital stock of $500,000 to carry on business as timber merchant and mill owner.

The Arcola Electric Light & Power Company, Ltd., Arcola, Sask., has been incorporated.

The Watrous Electric Light, Power & Traction Company, Ltd., Watrous, Saskatchewan, has increased its capital stock from $25,000 to $50,000.

The Acme Sash & Door Company, Ltd., Winnipeg, has been organized with a capital stock of $100,000 to engage in manufacturing. A. T. Wilson is the manager.

The power plant of the West Kootenay Power & Light Company, Ltd., Bonnington Falls, B. C., is to be enlarged. The manager of the company is Lorne Campbell, Rossland, B. C.

The ratepayers of Port Alberni, B. C., are to vote on a bylaw to install a waterworks system at a cost of $115,000. Information furnished by the town clerk.

Hooper & Hooper, 303 McIntyre Building, Winnipeg, are the architects for an addition to the factory of the Canada Paint Company, Ltd., in this city. It will be of brick and concrete construction and will be equipped with a freight elevator, motors, ventilating system and tanks.

The Capital Laundry Company, Regina, Sask., will erect a steam laundry at a cost of $65,000. The McKay Construction Company, Regina, is the general contractor.

The Dominion Trust Company, Vancouver, will establish a refrigerator plant. The managing director is W. R. Arnold.

It is rumored that Hamilton capitalists are negotiating with the Canadian Locomotive Works, Kingston, either with a view to getting the company to remove its plant there or to establish a branch.

Government Purchases

WASHINGTON, D. C., September 9, 1912.

The Bureau of Supplies and Accounts, Navy Department, Washington, will open bids October 8, under schedule 4822, for one molding machine for delivery to Mare Island, Cal., and schedule 4841, for two combination oil heaters and pumps.

The Bureau of Yards and Docks, Navy Department, will open bids October 15 for four centrifugal pumps, under schedule 4820, for delivery to Pearl Harbor, Hawaii.

The Treasury Department, office of the supervising architect, Washington, will open bids October 1 for furnishing a mechanical system of mail handling apparatus in the United States post office, New York City.

The Bureau of Supplies and Accounts, Navy Department, Washington, opened bids September 3 as follows:

Schedule 4758, class 11, one screw cutting engine lathe, 14-in., motor driven—Bidder 66, Manning, Maxwell & Moore, New York, $1,034, $1,049 and $1,078; 72, Niles-Bement-Pond Company, New York, $872; 78, Pacific Tool & Supply Company, San Francisco, Cal., $1,025; 86, Pratt & Whitney, Hartford, Conn., $1,322; 102, Springfield Machine Tool Company, Springfield, Ohio, $940; 105, Terminal Machine Company, Seattle, Wash., $890; 125, Eccles & Smith Company, San Francisco, Cal., $800; 127, Frevert Machinery Company, New York, $902.

Schedule 4759, class 12, one pipe expanding and flanging machine—Bidder 14, F. A. Brander & Co., New York, $4,560; 53, Lovekin Pipe Expanding & Flanging Machine Company, Philadelphia, Pa., $3,300.

Class 13, one improved pipe threading and cutting machine—Bidder 10, F. S. Banks & Co., New York, $504.80; Curtis & Curtis Company, Bridgeport, Conn., $530; 44, Harron, Ricard & McCone, San Francisco, Cal., $690; 46, Jarecki Mfg. Company, Washington, D. C., $803.40; 66, Manning, Maxwell & Moore, New York, $1,670; 72, Niles-Bement-Pond Company, New York, $1,270; 78, Pacific Tool & Supply Company, San Francisco, Cal., $1,175; 89, Rix Compressed Air & Drill Company, San Francisco, Cal., $1,560, $1,670, $1,728 and $1,838; 91, Rawles-Cobb Company, Boston, Mass., $451.25; 125, Eccles & Smith Company, San Francisco, Cal, $1,063; 127, Frevert Machinery Company, New York, $869 and $731.

Class 14, two belt-driven metal saws—Bidder 44, Harron, Ricard & McCone, San Francisco, Cal., $385; 66, Manning, Maxwell & Moore, New York, $399.90 and $264.60; 81, J. W. Paxson Company, Philadelphia, Pa., $331.

Announcement is made that the downtown site which the Crane Company has occupied for many years on Canal street, Chicago, has been sold to the Chicago, Burlington & Quincy Railroad for a consideration of $4,000,000. The portion of the property acquired by this railroad is on the east side of Canal street and is to be used in connection with the Union Depot project of the Pennsylvania Lines. The plant site on the west side of Canal street had been previously sold to the Soo Line for terminal purposes for a consideration understood to be $3,000,000. Information is not yet available concerning the new location for the Crane Company plants.

The Erie-Buffalo Tube Company, Erie, Pa., a Pennsylvania corporation, has succeeded the Buffalo Tube Company, a New York corporation, and will carry on the business of manufacturing ⅜-in. and smaller seamless brass and copper tubing.

Trade Publications

Stokers.—Under-Feed Stoker Company of America, Harris Trust Building, Chicago, Ill. Pamphlet entitled "Coal." Is a compilation of data accumulated in the past ten years and gives the results of numerous analyses of various classes of bituminous coal made by this company. The samples were taken in accordance with the rules of the American Society of Mechanical Engineers from cars and boiler rooms and include those from different bituminous mines, as well as a number of samples taken from industrial plants. The results secured by the use of the Jones underfeed mechanical stoker and how they are obtained are briefly given, together with a short description of the stoker.

Gravity Return System.—Westinghouse, Church, Kerr & Co., 10 Bridge street, New York City. Pamphlet. Describes and illustrates the Holly gravity return system which is intended for returning the water of condensation from steam pipes to boilers. A general description of the system is given, together with a statement of the savings that are effected by its use and the text is supplemented by typical elevation and plan views of the system. A partial list of users which include railway powerhouses, gas and electric companies, hotels, office buildings, steam railroads and industrial plants of various kinds completes the pamphlet.

Metal Working Machinery.—Willard Machine & Tool Company, Cincinnati, Ohio. Two circulars. Illustrate the Willard high power 13-in. engine lathe which was illustrated in *The Iron Age*, August 25, 1910, and an inclinable open back power press. The lathe has a three-step cone pulley and double back gears and is specially designed for manufacturing work. The press is designed for hard and continuous service in the production of a line of work which includes all kinds of blank cutting, punching, perforating, forming and bending of sheet metal. The make up of the two circulars is identical, illustrations of the tools being given at the top, followed by a brief description and a condensed table of specifications.

Hydraulic Turbines.—Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1629. Pertains to a line of horizontal and vertical, single and twin cylindrical plate steel hydraulic turbines which are suitable for direct connection to electric generators for pulp grinding, general paper mill work and driving mills. The various types are illustrated and briefly described and tables of power and speeds are included.

Multiple-Spindle Automatic Chucking Machine.—New Britain Machine Company, New Britain, Conn. Pamphlet. Lists the various types of multiple-spindle automatic chucking machines of this company which include those formerly built by George C. Prentice & Co., Inc. The machines are built in two distinct types, single head and double head. After a brief description of the single-head machine, the various sizes are illustrated and briefly described with condensed tables of specifications and the same arrangement is followed for the different sizes of double-head machines. Mention is also made of the various attachments which can be furnished for these machines and there are several illustrations of typical work.

Special Service Pumps.—Goulds Mfg. Company, Seneca Falls, N. Y. Bulletin No. 109. Describes with numerous illustrations a comprehensive line of power pumps for special services which require special features of construction. The style of pumps covered and designed especially for waterworks, oil pipe line, refinery, chemical, refrigerator, hydraulic pressure and similar services and in addition to these standard designs special units can be furnished for any particular service.

Elevator Motors.—Ideal Electric & Mfg. Company, Mansfield, Ohio. Bulletin No. 1091. Lists a number of different types of elevator motors which can be furnished for both direct and alternating current in a wide range of sizes. A number of these motors are illustrated and the performance curves of several of them are reproduced.

Metal Packings.—Metallic Packing & Mfg. Company, Elyria, Ohio. Catalogue G. Lists the various types of Martell metal packings for steam and gas engines, pumps, hydraulic presses and air compressors. The construction of this packing is described at considerable length and there are blueprints showing the various styles in which it can be furnished. Mention is also made of the No-If automatic engine stop which is also made by this company.

Automatic Gear Hobbing Machine.—Gould & Eberhardt, Newark, N. J. Catalogue. Concerned with a line of automatic gear hobbing machines for spur, helical and worm gears. After a brief description of the construction of these machines, the four sizes which go to make up the line are illustrated with a brief statement of the special fields for which they are adapted. Two representative products of the machines are illustrated and data on the prinicipal points are included.

Grinding Machine.—Wilmarth & Morman Company, Grand Rapids, Mich. Folder. Concerned with the New Yankee grinding machine which is equipped with cylindrical and internal grinding attachments and is intended for cutter, reamer, drill and general toolroom work. The arrangement of the machine for performing these various operations is described in some detail, and the text is supplemented by halftone engravings showing the position of the various parts. An illustrated description of this machine appeared in *The Iron Age*, July 4, 1912.